Ontario
Division of Mines

HONOURABLE LEO BERNIER, *Minister of Natural Resources*

Dr. J. K. REYNOLDS, *Deputy Minister of Natural Resources*

G. A. Jewett, Executive Director, Division of Mines *E. G. Pye, Director, Geological Branch*

Geology

of

Fawcett and Leonard Townships

Districts of Sudbury and Timiskaming

Compliments of
ONTARIO
MINISTRY OF NORTHERN DEVELOPME
AND MINES
Not for resale

by

M. W. Carter

Geoscience Report 146

TORONTO
1977

93-00830/

© ODM 1977

Publications of the Ontario Division of Mines
and price list
are obtainable through the
Mines Publication Office, Ontario Ministry of Natural Resources
Parliament Buildings, Queen's Park, Toronto, Ontario

and

The Ontario Government Bookstore
880 Bay Street, Toronto, Ontario

Orders for publications should be accompanied by cheque
or money order, payable to Treasurer of Ontario.

Parts of this publication may be quoted if credit is given to the Ontario Division of Mines. It is recommended that reference to this report be made in the following form:

Carter, M.W.
1977: Geology of Fawcett and Leonard Townships, Districts of Sudbury and Timiskaming; Ontario Div. Mines, GR146, 50p. Accompanied by Map 2359, scale 1 inch to ½ mile (1:31,680).

Car-1000-300-77

CONTENTS

PAGE

Abstract vii
Introduction 1
Location and Accessibility 1
Physiography 2
Previous Geological Work 2
Present Geological Work 2
Acknowledgments 3
General Geology 3
Table of Lithologic Units 4
Early Precambrian (Archean) 6
Metavolcanics and Metasediments 6
Mafic Metavolcanics 6
Intermediate Metavolcanics 9
Felsic Metavolcanics 12
Metasediments 14
Iron Formation 15
Ultramafic Rocks 16
Felsic Intrusive Rocks 17
Granite Lake Pluton 17
Feldspar and Feldspar-Hornblende Porphyries 18
Biotite Lamprophyre 20
Leucogranite 21
Early to Late Precambrian 21
Mafic Intrusive Rocks 21
Diabase Dikes 21
Middle Precambrian 21
Huronian 21
Cobalt Group 21
Gowganda Formation 21
Lorrain Formation 25
Mafic Intrusive Rocks 25
Nipissing Diabase 25
Phanerozoic 27
Cenozoic 27
Quaternary 27
Pleistocene and Recent 27
Structural Geology 27
Folding 27
Early Precambrian Metavolcanic-Metasedimentary Sequence 27
Huronian 28
Nipissing Diabase 29
Faulting 29
Foliation 30
Shearing 30
Economic Geology 30
History of Exploration 30
Character of Deposits and Recommendations to Prospectors 31
Gold 31
Iron 32
Silver and Cobalt 32
Description of Properties, Deposits and Explored Areas 34
Gold 34
Amax Potash Limited (1) 34
Barbour, M. (2) 34
Burkett, L.H. (3) 34

PAGE
Clarkson, I.B. (4) 35
Jonsmith Mines Limited (5) 36
Midrim Mining Company Limited [1966] (6) 36
Ramsay, R.G. (7) 36
Iron 38
McVittie, J.P. and Bennett, W.S. (16) 38
Shining Tree Lake Occurrence (20) 39
Silver 39
Archibald, E.B. (8) 39
Associated Porcupine Mines Limited (9) 40
Caswell-Eplett Prospect [1912] (10) 40
Coulee Lead and Zinc Mines Limited [1963] (11) 41
Decker, Albert (12) 42
Explorations Projects [1959] (13) 42
Greave, E.L. [1912] (14) 43
Leonard Silver Mines Limited [1912] (15) 43
Neelands Prospect [1912] (17) 44
Newnorth Gold Mines Limited [1957] (18) 44
Saville Exploration Syndicate [1909] (19) 44
Silver Dollar Mines Limited [1947] (21) 45
Silver Pack Mines Limited [1965] (22) 45
Sullivan, M.J. (23) 46
References Cited 47
Index 49

TABLES

1–Table of Lithologic Units 4
2–Chemical analyses of Early Precambrian metavolcanics 7
3–Chemical analyses recalculated to a water-carbon dioxide-free basis 10
4–Normative composition of Early Precambrian metavolcanics (Standard Katanorm) 11

FIGURE

PAGE
1–Key map showing location of Fawcett and Leonard Townships 7

PHOTOGRAPHS

1–Amygdaloidal, pillowed basalt 6
2–Chlorite-epidote-calcite schist 8
3–Plagioclase amphibolite 8
4–Andesite 10
5–Porphyritic rhyolite 13
6–Greywacke 14
7–Serpentinized dunite 17
8–Feldspar-hornblende porphyry 19
9–Biotite lamprophyre 19
10–Sagenite webs in biotite lamprophyre 20
11–Granite boulder conglomerate, Gowganda Formation 22
12–Polymictic conglomerate, Gowganda Formation 22
13–Greywacke, Gowganda Formation 23
14–Worm-like impressions in siltstone 24
15–Regular and irregular annular impressions in siltstone 24

GEOLOGICAL MAP

(back pocket)

Map 2359 (coloured)—Fawcett and Leonard Townships, Districts of Sudbury and Timiskaming.
Scale: 1 inch to ½ mile (1:31,680).

ABSTRACT

This report describes the geology and mineral occurrences in Fawcett and Leonard Townships, centred about 10 miles (16 km) east of the village of Shining Tree. The townships cover an area of about 84 square miles (220 km^2).

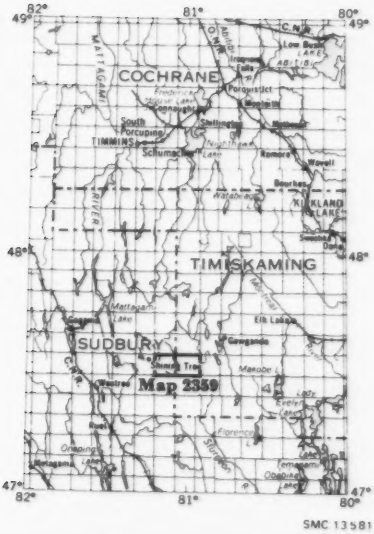


Figure 1–Key map showing location of Fawcett and Leonard Townships. Scale 1 inch to 50 miles (1:3,168,000).

All consolidated rocks in the area are of Precambrian age. These are covered by a mantle of Pleistocene and Recent deposits.

Early Precambrian rocks comprise a metavolcanic-metasedimentary sequence interlayered with ultramafic rocks and iron formation, an intrusive quartz monzonite pluton, and north-northeasterly and north-northwesterly trending diabase dikes. The metavolcanic-metasedimentary rocks consist mainly of basaltic to rhyolitic flows, pyroclastics and sandstones. Mafic metavolcanics are confined mostly to Fawcett Township, but intermediate and felsic metavolcanics predominate in Leonard Township. The ultramafic rocks consist of serpentinized dunite and peridotite and are of minor importance. The largest body of these rocks occurs in southeastern Fawcett Township and consists of peridotite, but it is not exposed. North-northwesterly trending diabase dikes of Matachewan type cut the metavolcanics, metasediments and the quartz monzonite. A few north-northeasterly trending diabase dikes cut the Early Precambrian rocks. These might be Late Precambrian dikes.

Middle Precambrian rocks are represented by Huronian sediments and Nipissing Diabase. The Huronian rocks belong to the Gowganda and Lorrain Formations of the Cobalt Group which unconformably overlies the Early Precambrian rocks. The sedimentary rocks comprise greywacke, conglomerate, arkose, and quartz arenite. The Nipissing Diabase occurs as two subhorizontal sills intrusive into the Cobalt Group and consists of diabase, quartz diabase, and minor syenite and granite. This diabase is best exposed in Leonard Township. Northerly and northeasterly trending diabase dikes also intrude the Cobalt Group and may belong to the Abitibi dike swarm.

Cenozoic rocks consist of sand, gravel and swamp and stream deposits. These cover about half the area of Fawcett Township and aboout one-third the area of Leonard Township.

Structurally the metavolcanics and metasediments are folded about northwesterly trending axes in Fawcett Township and north-northwesterly axes in Leonard Township. The major faults trend north-northwesterly and post-date the Nipissing Diabase.

Silver mineralization, associated with the Nipissing Diabase, was the chief economic feature of the area. Production was realized from numerous quartz-calcite veins within the sills by various operators during the first quarter of the 20th Century.

Geology

of

Fawcett and Leonard Townships

Districts of Sudbury and Timiskaming

by

M. W. Carter[1]

INTRODUCTION

Location and Accessibility

Fawcett and Leonard Townships straddle the boundary of the Districts of Sudbury and Timiskaming between Latitudes 47°29′30″ and 47°35′N, and Longitudes 80°55′ and 81°12′W. Fawcett Township is 6 miles (10 km) square, Leonard Township is 7½ miles (12 km) wide by six miles (10 km) long.

Access is moderately good. Fawcett Township may be reached by land by means of the Bay Lumber road branching off from Highway 560 at a point 51 miles (82 km) west from Elk Lake. This road traverses the length of Macmurchy Township and Fawcett Township in a southerly direction. By land, Leonard Township may be reached in two ways: by the Hydro-Electric Power Commission road branching off southerly from Highway 560 about a mile (2 km) before the western boundary of Tyrrell Township, or via the Bay Lumber road from Macmurchy Township into Ogilvie Township then eastwards to the Hydro-Electric Power Commission road intersection at Norman Lake in North Williams Township, and northwards into Leonard Township. This second route though circuitous is the better one. These branch roads are dry weather gravel roads, but Highway 560 is an all-weather gravel road.

Air access is available for both townships, the largest type of aircraft that can be used is a Cessna 180. By this means Fawcett Township can be reached using Fawcett and Shining Tree Lakes, and Leonard Township using Shining Tree Lake, Spider Lake or Soot Lake.

Water access is possible to both townships via Shining Tree Creek, from its intersection with Highway 560 in Macmurchy Township to Shining Tree Lake which spans the Fawcett-Leonard Township boundary. No rapids are encountered using this route. Fawcett Township may also be reached using the West Montreal River via a bush road branching eastwards off Highway 560 in southwestern Macmurchy Township.

---

[1]Geologist, Ontario Division of Mines, Toronto. Manuscript approved for publication by the Chief Geologist, 24 April, 1975.

Fawcett and Leonard Townships

Physiography

The map-area is one of relatively subdued relief; maximum differences occurring where hills formed by the Cobalt Group or Nipissing Diabase rise to 85 feet (25 m) above the level of Shining Tree Lake. The greatest elevations, 1,250 to 1,350 feet, (375-405 m) are encountered in the eastern and southeastern parts of Leonard Township, which are underlain by Cobaltian rocks, Nipissing Diabase and glacial deposits.

Pleistocene and Recent deposits cover about 40 percent of the area, and are up to 130 feet (40 m) thick in southeastern Fawcett Township.

Drainage is northerly and is carried by the West Montreal River and its tributaries: in western Fawcett Township by the West Montreal River itself; at the Fawcett-Leonard boundary by its tributary, Shining Tree Creek; and in the eastern part of Leonard Township by Wapus Creek.

Previous Geological Work

Geological investigations in the area began in 1896, when Burwash (1896) examined the country along the Nipissing-Algoma line, part of which forms the common boundary between Fawcett and Leonard Townships. During this investigation he was accompanying Niven's Ontario Land Survey party. This investigation was followed by that of Coleman's (1901) who travelled to Shining Tree Lake in 1900 to examine the iron ranges previously reported by Burwash (1896). No further work was carried out in the area until 1908 when Collins (1913b) began his investigations of Leonard Township, and Fawcett and Leonard Townships (Collins 1917). A series of progress reports by Collins (1911, 1912, 1913a) and Memoirs (Collins 1913b, and 1917) also contain data for the area mapped. The stimulus for this work was the exploration for gold and silver. In 1911, Stewart (1912) examined the West Shining Tree gold area which included Fawcett Township, and Collins (1912) mapped the western part of Fawcett Township. Following this, in the year 1912, Stewart (1913a, b) returned to the region and mapped the western part of Fawcett Township and the western half of Leonard Township.

No further mapping was carried out in the area until 1919, when Hopkins (1920) made a preliminary examination of the West Shining Tree gold area, and prepared a revised map of the area including part of Fawcett Township, incorporating and extending the work of Collins and Stewart. In 1925, Finley (1926) examined the Wasapika Section of the West Shining Tree gold area, and referred to mineralized veins in Fawcett Township; no mapping was undertaken by Finley. In 1926 Langford (1927) mapped the whole of Leonard Township and adjoining parts of Fawcett and Tyrrell Townships.

Present Geological Work

Field work for this project was carried out during the summer of 1972, using vertical aerial photographs at a scale of 1 inch to ¼ mile (1:15,840) supplied by the Timber Branch, Ministry of Natural Resources. Pace-and-compass traverses were run at intervals

of ¼ mile (0.4 km) in areas where outcrop was extensive. In other cases, traverses were run irregularly where outcrop was sparse, so as to examine all exposures. Traverses across outcrop areas were run at right angles to the strike in most cases. Logging roads were also used in the search for outcrop. Geological data were plotted directly onto acetate sheets which were attached to the aerial photographs and were carried on the traverses. The data were then transferred to 1 inch to ¼ mile (1:15,840) cronaflex base maps. Base maps were compiled by the Cartography Section of the Geological Branch, from Forest Resources Inventory maps of the Silviculture Section, Ministry of Natural Resources. Two preliminary, uncoloured, geological maps, P.819 and P.820 covering Fawcett and Leonard Townships respectively, were published in 1973 (Carter 1973a, b), at a scale of 1 inch to ¼ mile (1:15,840).

Acknowledgments

During the field work the author was assisted by: E.M. Fraser senior assistant, and A. Grant, G. Einarson and D. Bodner junior assistants. Their help in carrying out the mapping is greatly appreciated. Mr. Fraser conducted detailed mapping of an area about 1/16th square mile (0.16 km²) in extent for a bachelor's thesis (Fraser 1973).

The author wishes to thank Mr. Howard Lovell, Resident Geologist of the Ministry of Natural Resources at Kirkland Lake, for valuable discussions and help during the season, and Mr. and Mrs. G. Cruikshank for their many courtesies and help during the mapping project.

GENERAL GEOLOGY

The lithological units indicated on the map face are listed in Table 1 in the order of decreasing age as far as this could be determined.

The oldest rocks of the area forming the local basement comprise the Early Precambrian metavolcanic-metasedimentary sequence, map units 1-4. The ultramafic rocks, map unit 5, may be intrusive and interlayered with the metavolcanic-metasedimentary sequence.

The Granite Lake pluton is intrusive into the basement rocks, intrusive relationships being observed in Fawcett Township along the northern parts of the pluton. Unconnected feldspar porphyry dikes and irregular masses are grouped with this pluton because of either close spatial relationship to the pluton or lithological similarity with observed feldspar porphyry masses within and cutting the pluton. These feldspar porphyries are also observed to cut the metavolcanics. All these porphyries are distinguished from the volcanic feldspar porphyries by their brown to dark grey colour, coarser matrix and cross-cutting relationships with the volcanics.

Diabase dikes within the map-area trend NNW, NNE, NE, and north. They cut Early Precambrian metavolcanics and metasediments, the Granite Lake pluton and the Huronian rocks. Fawcett and Leonard Townships lie within the region containing Matachewan and Abitibi dike swarms (Fahrig *et al.* 1965, p.284, Figure 2). The Matachewan dikes (Fahrig *et al.* 1965, p.291) are described as 'a northerly striking swarm' and the Abitibi dikes (op. cit. p.283) as 'a northeasterly trending swarm'.

Table 1 | TABLE OF LITHOLOGIC UNITS FOR FAWCETT AND LEONARD TOWNSHIPS.

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Sand, gravel, swamp and stream deposits

Unconformity

PRECAMBRIAN

EARLY TO LATE PRECAMBRIAN

Mafic Intrusive Rocks

Diabase, porphyritic diabase

Intrusive Contact

MIDDLE PRECAMBRIAN

Mafic Intrusive Rocks (Nipissing Diabase)

Diabase, quartz diabase, hornblende gabbro, granophyre, granite, syenite

Intrusive Contact

HURONIAN SUPERGROUP

COBALT GROUP

Lorrain Formation

Arkose, quartz arenite

Gowganda Formation

Arkose, quartz arenite, argillite, conglomerate, paraconglomerate, greywacke, calciferous arkose, rhythmite, siltstone

Unconformity

EARLY PRECAMBRIAN (ARCHEAN)

Felsic Intrusive Rocks

Hornblende quartz monzonite, biotite-hornblende-quartz monzonite, biotite-quartz monzonite, feldspar-hornblende porphyry, feldspar porphyry, leucogranite, biotite (chloritized) lamprophyre

Intrusive Contact

ULTRAMAFIC INTRUSIVE ROCKS

Dunite (serpentinized), peridotite

METAVOLCANICS AND METASEDIMENTS

METASEDIMENTS

Quartz arenite, chert, greywacke, siltstone conglomerate, breccia

FELSIC METAVOLCANICS

Rhyolite-rhyodacite: aphanitic, porphyritic, flows and pyroclastic rocks; quartz-sericite schist.

INTERMEDIATE METAVOLCANICS

Andesite-dacite: aphanitic, porphyritic, pillowed and amygdaloidal flows, and pyroclastics; actinolite-quartz-feldspar schist

MAFIC METAVOLCANICS

Basalt: aphanitic, pillowed, foliated, amygdaloidal, and vesicular flows; breccia, amphibolite, and amphibole-feldspar schist

IRON FORMATION

Hematite, magnetite, chert, jasper, pyrite

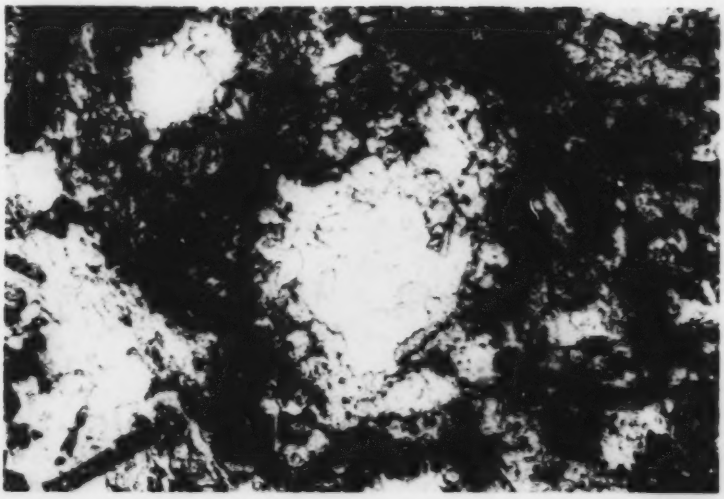
Current mapping has shown that northerly trending dikes cut both the Early Precambrian and Huronian sequences, and northeasterly dikes cut the Cobalt sediments. Also, a large number of dikes which cut the Early Precambrian rocks and the Granite Lake pluton trend NNW. This indicates that trend directions cannot be used uniquely to define the relative ages of these dikes. Because of this, all diabase dikes found cutting only the Early Precambrian rocks are grouped together, whether they trend NNW, NNE, or north as Early to Late Precambrian. As dikes cutting Cobaltian sediments and trending either north or NE were not observed to cut the Nipissing sills, they may be of the same age as the Nipissing and hence are grouped with them.

Middle Precambrian Huronian sediments comprising the Gowganda and Lorrain Formations overlie the Early Precambrian rocks unconformably.

Rocks east and southeast of Soot Lake and west of Fisher and Irene Lakes were grouped by both Collins (1913b) and Langford (1927) as Cobaltian, but uncertainty as to their stratigraphic position was indicated by Langford (1927, p.91) when he wrote: 'To the east of Black (Soot) Lake it is often difficult to distinguish between the coarse quartzitic sediments of the Late Keewatin and the fine phases of the Cobalt conglomerate. This difficulty is increased by the presence of large swamp areas and the smallness of the outcrops.' This 'Late Keewatin' was understood to be Timiskaming in the general area at that time. Rocks classed as Cobaltian east of Black (Soot) Lake and west of Slim Lake by Langford (1927), were grouped as 'Timiskamian' by Graham (1932, p.36-37) where they extend into Tyrrell Township. The confusion arises from the similarity of the rock types and the apparent view that sediments were absent in sequences classed as Keewatin. Current mapping, however shows that sediments are both interlayered with and unconformably overlying the felsic and intermediate metavolcanics. The felsic metavolcanics and the interlayered sediments associated with them are now accepted as the upper part of an Early Precambrian volcanic cycle.

Nipissing Diabase and quartz diabase occur within the map-area outcropping over large areas. The intrusive relationship to the Gowganda Formation was observed along the eastern shores of Shining Tree Lake and the structural relationship to the Gowganda and Lorrain Formations indicate that the large masses are parts of intrusive sills.

As considerable erosion has occurred since the intrusion of the Nipissing Diabase, irregular areas of diabase occur which cannot unequivocally be considered to be dikes and have been interpreted as outliers of Nipissing Diabase. They are accordingly coded as unit 10. Many of these irregular masses have been referred to as post-Nipissing dikes by Collins (1913b) and Langford (1927). However, no contact relationships between sills and dikes were reported by either Collins or Langford. Concerning this relationship Collins (1913b, p.95) states: 'Ordinarily dikes are associated with some large parent mass. In this case the quartz diabase is the only important intrusion to which the olivine diabase dikes might be so related. No conclusive proof of such a relationship is known, . . .'. Langford (1927, p.92) writes concerning these supposedly post-Keweenawan dikes: 'Nowhere were they seen to cut the Keweenawan.' The Nipissing Diabase was considered by Langford to be Keweenawan in age.



ODM9258

Photo 1–Photomicrograph of amygdaloidal, pillowed basalt showing intersertal-ophitic texture (× 20). Plane polarized light. Specimen E10-19.

EARLY PRECAMBRIAN (ARCHEAN)

Metavolcanics and Metasediments

MAFIC METAVOLCANICS

The rocks mapped as Early Precambrian mafic metavolcanics in the map-area are of basaltic composition (Table 2). They are dark green to black in colour, fine-grained or diabasic in texture and are predominantly flow rocks. Pillowed, vesicular and amygdaloidal structures are present. The rocks are of uniform aspect in field appearance and are not apparently markedly altered. Where these rocks show a diabasic texture, they can be distinguished only with difficulty from Nipissing Diabase, where the two units are in contact. Where the basalts are altered, they are dark green in colour and contain epidote either as stringers up to 1 inch, (25 mm) wide, or as irregular areas. Within the aureole of the Granite Lake pluton, a pronounced schistose structure is developed.

The basaltic metavolcanics are best exposed in the eastern and western parts of Fawcett Township. In Leonard Township they are rare and occur only in the west-northwestern parts.

A photomicrograph from an amygdaloidal pillowed basalt is shown in Photo 1. In thin section the rock shows intersertalophitic texture between plagioclase and augite,

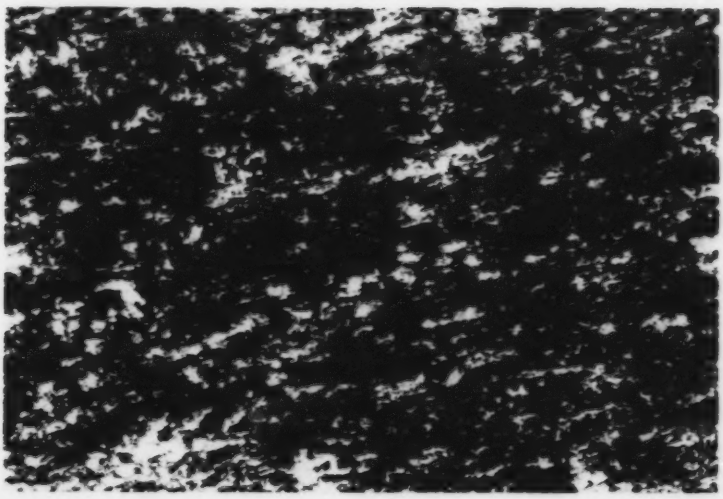
Table 2 | CHEMICAL ANALYSES OF ROCK SAMPLES FROM THE EARLY PRECAMBRIAN METAVOLCANICS.

Sample	1	2	3	4	5
			Weight Percent		
SiO_2	47.90	50.90	52.50	56.60	76.70
Al_2O_3	15.20	12.60	13.20	16.80	13.30
Fe_2O_3	4.93	3.00	3.04	0.93	0.43
FeO	6.81	11.80	8.51	5.35	0.41
MgO	4.90	4.95	5.60	4.45	0.45
CaO	13.20	9.10	8.72	7.13	0.81
Na_2O	2.02	2.37	1.97	2.56	5.39
K_2O	0.12	0.36	0.10	0.34	1.21
TiO_2	1.06	1.60	1.01	0.94	0.13
P_2O_5	0.07	0.12	0.10	0.37	0.17
S	0.09	0.06	0.20	0.02	0.01
MnO	0.21	0.25	0.19	0.11	0.03
CO_2	1.53	0.25	0.23	0.70	0.40
H_2O+	1.06	1.51	2.92	2.65	0.52
H_2O-	0.07	0.12	0.16	0.15	0.16
Total	99.17	98.99	98.45	99.10	100.12

1. Chlorite-epidote-calcite schist, northwest Fawcett Township. Specimen E2-7.
2. Plagioclase amphibolite, about one-quarter mile (0.4 km) north of the metavolcanics/quartz monzonite contact in southwestern Fawcett Township. Specimen H2-8.
3. Amygdaloidal pillowed basalt, northwestern shore of Spider Lake, Leonard Township. Specimen E10-19.
4. Porphyritic andesite, northeastern shore, Spider Lake, Leonard Township. Specimen E10-10.
5. Porphyritic rhyolite, from the central part of the Macmurchy-Fawcett Township boundary. Specimen E3-1.

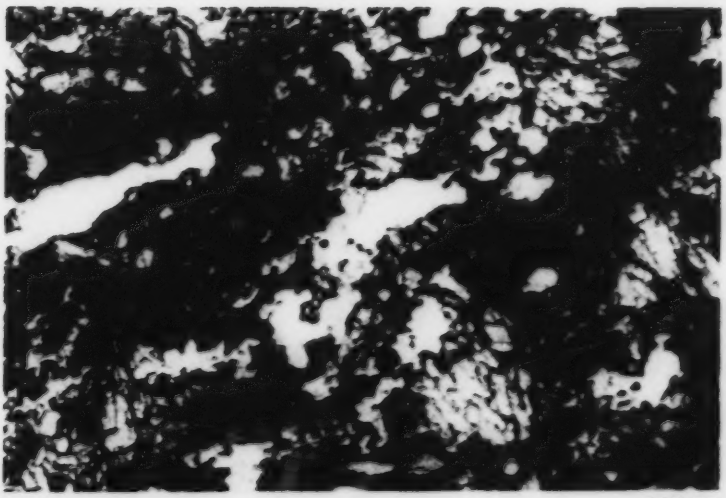
associated with irregular areas filled with pale green isotropic to dark blue birefringent chlorite, interstitial cryptofelsite and quartz grains. The feldspar laths are too altered for reliable identification but lamellar twinning can still be observed. The rock contains 6 percent quartz, 19 percent altered feldspar, 9 percent augite, 45 percent epidote, 5 percent clinozoisite, 13 percent chlorite and 3 percent opaques and sericite. The chemical analysis of this rock is given in Table 2 (No.3) and the norm in Table 4 (No.3). On the basis of its normative composition and colour index (molecular), this rock is classified as a tholeiitic basalt according to the classification of Irvine and Baragar (1971).

Examples of the metamorphic textures developed in these rocks are shown in Photos 2 and 3. Photo 2 is a photomicrograph of a very fine grained megascopically massive mafic metavolcanic rock which occurs within 200 feet (60 m) of a mile-long (1.6 km) fault in northwestern Fawcett Township. In thin-section all primary texture has been destroyed. The major minerals present are chlorite and epidote with accessory calcite. The chemical analysis of the rock is given in Table 2 (No.1) and its norm in Table 4 (No.1). These confirm the grouping of the rock with the basalts. Photo 3 represents a megascopically foliated mafic metavolcanic rock which occurs one-eighth of a mile (200 m) from the monzonite/basalt contact. Thin section examination reveals decussate texture, the major constituents being hornblende occurring in euhedral or ragged anhedral



ODM9259

Photo 2–Photomicrograph of chlorite-epidote-calcite schist (×20). Plane polarized light. Specimen E2-7.



ODM9260

Photo 3–Photomicrograph of plagioclase amphibolite (×20). Plane polarized light. Specimen H2-8.

grains, and associated plagioclase feldspar. The hornblende grains average 0.4 mm by 0.2 mm in size and comprise 66 percent of the rock. The pleochroic scheme of this hornblende is X = green, Y = yellow and Z = blue. The plagioclase feldspar is oligoclase (An_{20}) and comprises 12 percent of the rock. It is cloudy and twinned in some grains. Quartz is present and amounts to 8 percent, consisting of aggregate grains showing wavy extinction due to strain. Epidote forms 12 percent of the rock. Accessory minerals are calcite (1 percent), opaques and sphene 1 percent. The rock indicates the attainment of the amphibolite facies (Turner 1968) of regional metamorphism within the map-area. The chemical analysis of this rock is given in Table 2 (No.2) and the norm in Table 4 (No.2).

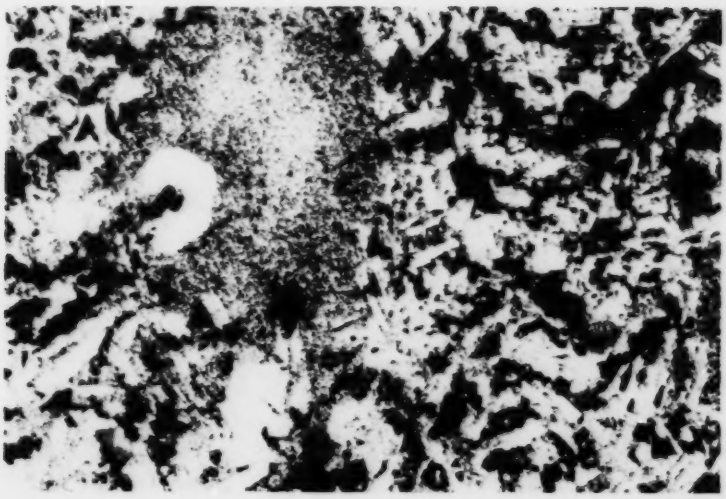
A small exposure of basalt breccia (1c) was located in northeastern Fawcett Township. The outcrop consisted of angular fragments of basalt 4 inches (10 cm) across in a matrix of similar composition. It is regarded by the writer as a flow-top breccia. The exposure is located within 100 feet (30 m) of overlying quartz arenite.

INTERMEDIATE METAVOLCANICS

Rocks mapped as intermediate metavolcanics are considered to be of andesitic-dacitic composition. They are green to pale grey-green in colour and are commonly aphanitic, but porphyritic and amygdaloidal textures also occur. Pillowed structure was observed on many outcrops. These rocks occur more prevalently in Leonard Township than in Fawcett Township, and are distinguished in the field from the basalts on the basis of lighter green body colour and more siliceous character as indicated by their hardness (they cannot be scratched by a penknife).

A thin section of a megascopically aphanitic andesite is shown in Photo 4. The photomicrograph shows porphyritic hyalopilitic texture and the original glass is now devitrified. The phenocrysts consist of small subhedral, partially corroded grains of quartz which show aggregate polarization. These phenocrysts are commonly associated with devitrified glass. The plagioclase feldspar laths show irregular orientation in thin section and are associated with small grains of epidotized augite. Most of the ferromagnesian material is represented by dark brown cloudy alteration products. The rock consists of 2 percent quartz phenocrysts, 19 percent plagioclase (acid labradorite, An_{55}) in a matrix forming 61 percent of the rock and consisting of devitrified glass in which occur epidote (14 percent), sericite (3 percent), and opaque mineral (1 percent). The chemical analysis of this rock is shown in Table 2 (No.4) and the norm in Table 4 (No.4). On the basis of the normative feldspar composition and colour index (molecular), this rock is classified as a calc-alkaline high alumina basalt in the classification system of Irvine and Baragar (1971). However, the silica content of this rock as adjusted to a dry basis (Table 3, No.4) is 10 percent higher than that for their typical high alumina basalt (op.cit. p.564). The analysis given in this report compares more closely with a calc-alkaline andesite as indicated in the Appendix II (op. cit.).

Although dacitic rocks are believed to occur in the map-area, no examples have been studied in thin-section or chemically. These rocks are considered to be transitional between andesites and rhyolites and would contain modal quartz and a higher silica content.



ODM9261

Photo 4—Photomicrograph of andesite showing porphyritic-hyalopilitic texture (×20). Plane polarized light. Specimen E10-10.

Table 3 CHEMICAL ANALYSES OF ROCK SAMPLES FROM THE EARLY PRECAMBRIAN METAVOLCANICS RECALCULATED TO A WATER-CARBON DIOXIDE-FREE BASIS.

Sample	1	2	3	4	5
	Weight Percent				
SiO_2	49.70	52.40	55.20	59.20	77.50
Al_2O_3	15.80	13.00	13.90	17.60	13.40
Fe_2O_3	2.66	3.09	2.64	0.97	0.43
FeO	9.29	12.10	9.46	5.60	0.41
MgO	5.09	5.10	5.89	4.65	0.45
CaO	13.70	9.37	9.18	7.46	0.82
Na_2O	2.10	2.44	2.07	2.68	5.44
K_2O	0.12	0.37	0.11	0.36	1.22
TiO_2	1.10	1.65	1.06	0.98	0.13
P_2O_5	0.07	0.12	0.11	0.39	0.17
S	0.09	0.06	0.21	0.02	0.01
MnO	0.22	0.26	0.20	0.12	0.03
Total	99.94	99.96	100.03	100.03	100.01

1. Chlorite-epidote-calcite schist, northwest Fawcett Township. Specimen E2-7.
2. Plagioclase amphibolite, about one-quarter mile (0.4 km) north of the metavolcanics/quartz monzonite contact in southwestern Fawcett Township. Specimen H2-8.
3. Amygdaloidal pillowed basalt, northwestern shore of Spider Lake, Leonard Township. Specimen E10-19.
4. Porphyritic andesite, northeastern shore, Spider Lake, Leonard Township. Specimen E10-10.
5. Porphyritic rhyolite, from the central part of the Macmurchy-Fawcett Township boundary. Specimen E3-1.

Table 4 NORMATIVE (MOLECULAR) COMPOSITION OF EARLY PRECAMBRIAN METAVOLCANICS SAMPLES. (STANDARD KATANORM)

Sample	1	2	3	4	5
Quartz	1.66	6.14	11.65	15.69	36.21
Orthoclase	0.75	2.26	0.64	2.12	7.23
Albite	19.21	22.59	19.01	24.24	48.89
Anorthite	33.96	24.09	28.89	34.75	2.94
Enstatite	6.50	9.98	12.57	12.95	1.26
Ferrosilite	5.10	10.34	8.43	6.78	0.17
Diopside	15.66	9.05	8.09	0.00	0.00
Hedenbergite	12.28	9.37	5.43	0.00	0.00
Ilmenite	1.56	2.37	1.51	1.38	0.18
Magnetite	2.84	3.33	2.82	1.03	0.45
Apatite	0.16	0.27	0.22	0.82	0.36
Pyrrhotite	0.32	0.22	0.74	0.07	0.04
Corundum	—	—	—	0.17	2.27
Chromite	—	—	—	—	—
Total	100.00	100.01	100.00	100.00	100.00
Sample	**1**	**2**	**3**	**4**	**5**
Normative Plagioclase composition (percent An)	63.87 Labradorite	51.60 Labradorite	60.32 Labradorite	58.91 Labradorite	5.67 Albite
Differentiation Index (molecular)	21.62	30.99	31.29	42.05	92.34
Colour Index (molecular)	43.04	44.43	38.85	22.85	2.06
Specific Gravity	—	3.07	—	—	—

1. Chlorite-epidote-calcite schist, northwest Fawcett Township. Specimen E2-7.
2. Plagioclase amphibolite, about one-quarter mile (0.4 km) north of the metavolcanics/quartz monzonite contact in southwestern Fawcett Township. Specimen H2-8.
3. Amygdaloidal pillowed basalt, northwestern shore of Spider Lake, Leonard Township. Specimen E10-19.
4. Porphyritic andesite, northeastern shore, Spider Lake, Leonard Township. Specimen E10-10.
5. Porphyritic rhyolite, from the central part of the Macmurchy-Fawcett Township boundary. Specimen E3-1.

Fawcett and Leonard Townships

Andesitic-dacitic pyroclastic rocks are subdivided on the basis of predominant grain size into tuffs, lapilli tuffs and tuff-breccias after Fisher (1966). The clasts in these rocks may be angular, subrounded or rounded. These rocks are best exposed in the Spider and Soot Lakes area in north-central Leonard Township. Stratification is usually absent, but was observed in some places. The tuffs are aphantic and fine-grained granular rocks which vary in colour from light grey to dark grey. Clasts in these rocks consist of crystals of feldspar and quartz and intermediate volcanic rocks. They are set in a greenish to grey fine-grained chloritic matrix. Lapilli tuffs are similar except that clasts are of a larger size.

Within the aureole of the Granite Lake pluton, which is about a mile (1.6 km) wide, the intermediate volcanic rocks are metamorphosed and foliated. The schistose texture is not always evident in the hand specimens but can be observed in thin section. The typical rock is an actinolite-feldspar-quartz schist and in thin section consists of 8 percent quartz, 54 percent altered albitic feldspar, 20 percent actinolite, 10 percent epidote, 7 percent chlorite and 1 percent opaques. The alteration products of the plagioclase are epidote, and brownish alteration material.

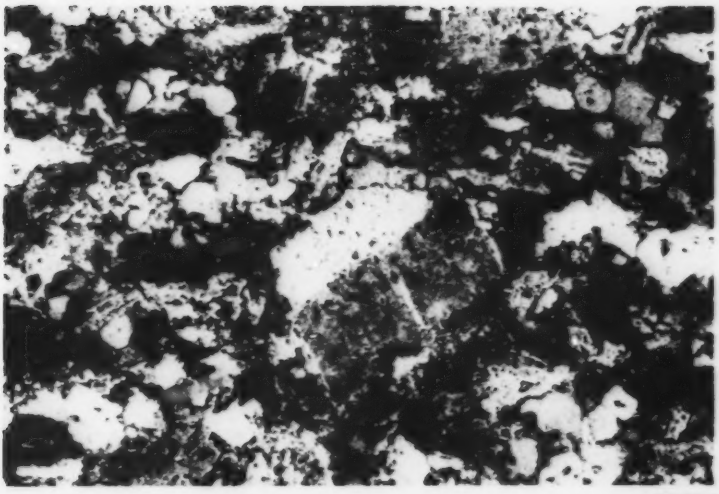
FELSIC METAVOLCANICS

The rocks mapped as felsic metavolcanics are rhyolitic-rhyodacitic in composition. These rocks are recognized by their siliceous flinty aspect in the field, their hardness (they cannot be scratched by a penknife) and by their colour which is light grey, cream, yellow, orange, or red. Where porphyritic, the abundance of quartz or quartz and feldspar phenocrysts aids in their identification. They occur throughout the area but are dominant in north-central Leonard Township.

Photo 5 is a photomicrograph of the typical texture of the porphyritic lavas. The rock consists of phenocrysts of quartz, orthoclase, and plagioclase feldspar set in a microgranular matrix. The quartz phenocrysts observed elsewhere in the thin section are rounded and show corrosion by the matrix. At the phenocryst grain boundaries some micropegmatite is developed. Strain extinction can be observed in the quartz grains. The plagioclase phenocrysts are subhedral, show alteration to calcite and sericite in varying degrees, and are corroded by the matrix. Lamellar twinning is more frequent than simple twinning. The feldspar of the matrix is much more altered than the phenocrysts, and consists of perthite and plagioclase (albite, An_6).

Modally the rock consists of 8 percent quartz, 20 percent albite (An_6), as phenocrystic material in a matrix of 42 percent altered albite, orthoclase and perthite, 13 percent sericite, 2 percent epidote, and 2 percent calcite. The chemical analysis of this rock is shown in Table 2 (No.5) and the norm in Table 4 (No.5), indicating 36 percent quartz to be present.

The term breccia has been used to describe one exposure of felsic volcanic rocks in the area consisting of angular fragments set in a finer grained volcanic matrix of the same composition. The rock did not appear to be pyroclastic and is regarded by the author as a brecciated lava. It is exposed near Spider Lake, and consists of angular fragments 4



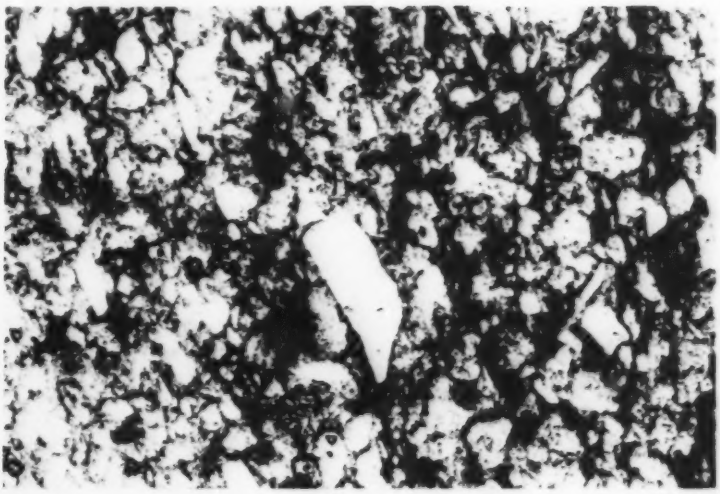
ODM9262

Photo 5—Photomicrograph of porphyritic rhyolite (×20). Crossed nicols. Specimen E3-1.

inches (10 cm) across of red rhyolite set in finer material of the same composition. It may represent a flow-top breccia.

Pyroclastic felsic metavolcanics are here subdivided on the basis of the size of the predominant clasts into tuffs, lapilli tuffs, and tuff-breccia after Fisher (1966). The tuffs are composed of aphanitic to sand-sized grains or fragments and are best exposed in the Soot Lake area in northern Leonard Township. They show the same colour variation as the lavas. In the tuffs the visible clasts may be either crystals of quartz and feldspar or felsic volcanic rocks; however, those containing crystals are by far the commonest types. These tuffs are more frequent than either lapilli tuff or tuff-breccias. In the lapilli tuffs lithic fragments predominate over crystal fragments, the lithic fragments consisting of felsic, aphanitic or porphyritic, volcanic rocks.

Within the metamorphic aureole of the Granite Lake pluton in northwestern Fawcett Township the felsic volcanic rocks are metamorphosed and develop a foliate structure. In most places this foliation can be observed in the field, but in a few outcrops the rocks appear to be massive. In the massive looking rocks, however, the foliation can be seen in thin sections. The felsic metavolcanics have been metamorphosed to quartz-sericite schist. A thin-section cut from one of the quartz-sericite schists shows 44 percent quartz, 12 percent albite, and 42 percent sericite. The sericite flakes are oriented and determine the foliation in the rock.



ODM9263

Photo 6–Photomicrograph of greywacke from the metavolcanic-metasedimentary sequence (× 20). Plane polarized light. Specimen E11-25b.

METASEDIMENTS

These rocks comprise quartz arenites, chert, greywacke, siltstone, conglomerate and breccia. They occur as relatively thin interbeds in the metavolcanic sequence both in Fawcett and Leonard Townships. In Fawcett Township they are best exposed to the north of Granite Lake where they are interbedded with the mafic metavolcanics. In Leonard Township they are best exposed in Soot Lake. Some of these rocks show well developed primary features such as graded bedding, ripple marks and flame structures.

The quartz arenites are buff or brown, medium-grained rocks which weather white, and are best exposed in Fawcett Township at a lake ¾ mile (1.2 km) northeast of Granite Lake. They are massive, or foliated, and are composed predominantly of quartz grains with less than 25 percent feldspar.

Chert is not a common rock type but occurs in the area southwest of the southern part of Soot Lake. The rocks are aphanitic, black, or grey and in some cases are banded, and have a well developed cleavage parallel to the lamination.

Greywacke is best exposed along the shores of Soot Lake in Leonard Township. These rocks are dark grey, commonly show graded bedding and occur in beds from about 1 inch (25 mm) to 6 inches (15 cm) thick. Primary sedimentary features including graded bedding, ripple marks and flame structures are frequently observed in them. A typical example of the texture of the greywackes is shown in Photo 6. The rock consists of an unsorted aggregate of angular chips of quartz (12 percent) which predominate, and which are associated with subordinate feldspar (3 percent) in a matrix consisting

mainly of sericite and feldspar amounting to 75 percent. The quartz grains lie parallel to the bedding and are elongate. The feldspar grains which are mostly alkali feldspar are equant in shape and are embayed by the matrix. Under plane polarized light the matrix is pale brown in colour. It consists mostly of sericite, much of which is wrapped around the detrital grains. Opaque ferruginous material (10 percent) encloses the grains and occurs in narrow bands parallel to the bedding. Accessory minerals are apatite and chlorite.

Siltstones are also not very common in the map-area but occur among the sediments northeast of Granite Lake in Fawcett Township and associated with the sediments at Soot Lake. They are buff or brownish weathering rocks, which show graded bedding.

Rocks classified as conglomerate and breccia, consist of pebbles and cobbles of felsic to intermediate metavolcanic rocks and jasper set in a granular sand-sized matrix which may be grey or greenish in colour consisting of grains of felsic intermediate metavolcanics, and crystals of quartz and plagioclase. In some cases the pebbles and cobbles are angular. These rocks are restricted to and are best exposed along the eastern shore of Soot Lake.

In northwestern Fawcett Township white weathering quartz arenite is the commonest of the metasediments, in Leonard Township greywacke is predominant. The metasediments are interlayered with mafic metavolcanics in the former locality but at Soot Lake in Leonard Township they are interlayered with felsic and intermediate metavolcanics. They differ from the aphanitic felsic metavolcanics by having coarser grain, a higher proportion of argillaceous material, and the presence of sedimentary structures. In the coarser varieties they differ from crystal tuffs in that the grains of the sediments are interlocking without the presence of a finer grained matrix. This distinction is well displayed in the Soot Lake exposures where crystal tuffs show grains of quartz and feldspar up to 4 mm across set in a finer quartzo-feldspathic non-argillaceous matrix. The texture of the tuff is unsorted.

IRON FORMATION

Iron formation occurs only in Leonard Township in two areas: near the Leonard-Tyrrell Township boundary in the northwestern part of Leonard Township, and in central Leonard Township at Fournier Lake. The formations are interbedded with the metavolcanics.

In northern Leonard Township the iron formation consists of red jasper, dark grey chert, hematite, and magnetite with minor pyrite (less than 1 percent). The material is banded and consists of laminae varying in width from a fraction of a millimeter to 5 mm. The weathered parts show encrustations of fine yellow limonite. The strike of the formations west of Bobtail Lake is N40°W and that of the body north of Spider Lake is N30°W. The dip in the former case could not be ascertained, but in the latter case it was 65°W. The units are about 200 feet (60 m) wide at outcrop.

In central Leonard Township a band of iron formation occurs northwest and southeast of Fournier Lake. The occurrence north of Fournier Lake consists of magnetite and pyrite, the latter forming 15 percent of the material. This mass occurs interbedded with felsic and intermediate metavolcanics and has been mapped over a strike length of 2,400 feet (720 m). Its width is about 150 feet (45 m) and it strikes N30°W. The dip was not ascertainable. The second set of exposures which occur from about ½ to 1 mile (0.8-1.6 km) southeast of Fournier Lake consist of banded magnetite, hematite and

jasper interlayered with felsic metavolcanics. This body was fully described by Collins (Collins 1911, 1913, 1917) when it was being explored.

> The Shining Tree iron range . . . forms a ridge 350 feet [105 m] wide and 1¼ miles [2 km] long from north to south. This ridge consists of several parallel bands of iron formation alternating with chloritic and sericitic schists, the schists and iron formation striking slightly west of north and dipping 85° west . . .
>
> The iron formation is a thinly stratified rock consisting of alternating siliceous and iron-bearing layers from ¼ to 1 inch [0.6-2.5 cm] thick. The iron-rich layers, composed of minute magnetite octahedra embedded in silica, are dark grey or black; the lean layers vary from different shades of grey to bright red.
>
> (Collins 1917, p.124).

> Certain bands or slender lenses carry enough iron oxide to be nearly black and strongly magnetic. The largest, including minor lean bands, is from 40 to 50 feet [12-15 m] wide, and persists as a succession of thin lenses for 4,000 feet [1200 m] along the strike. This rock band is crusted superficially with limonite, but a little below the surface seems to be siliceous iron formation heavily impregnated with magnetite and hematite.
>
> (Collins 1913b, p.113-114).

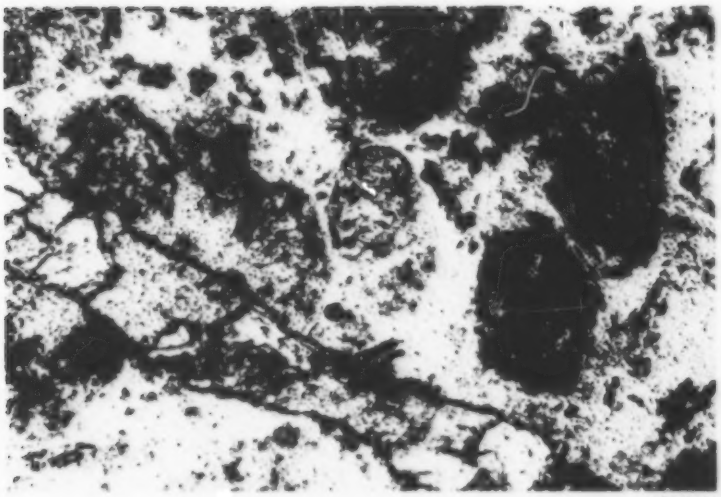
> Under the microscope the rock is seen to consist mainly of finely granular quartz, in alternate layers of which small octahedral crystals of magnetite are concentrated. Shreds of colourless secondary mica arranged along the stratification plane are fairly abundant. No clastic texture is apparent. The total amount of magnetite present does not usually exceed 15 percent.
>
> (Collins 1917, p.124-125).

Ultramafic Rocks

Ultramafic rocks are scarce in the map-area. Only in one place at about ½ mile (0.8 km) southeast of Hasset Lake in northwestern Fawcett Township was an outcrop of such rocks located. However, in southeastern Fawcett Township ultramafic rocks were reported from drill holes bored into the Early Precambrian metavolcanic-metasedimentary sequence (Assessment Work Files).

The ultramafic rock exposed in northwestern Fawcett is a serpentinized dunite. The exposure is small, and is emplaced in mafic metavolcanics. No asbestos bands or mineralization was observed at the outcrop. In thin section the rock is seen to be completely altered. The shape of the altered grains, now composed of talc and carbonates, however, indicate that the original mineral was olivine as shown in Photo 7. The pseudomorphosed olivine grains are surrounded by a structureless pale green secondary material which may be isotropic or may show very low grey birefringence colours and wavy extinction. This material is regarded as made up of secondary serpentine minerals. Veinlets of carbonate with square and rectangular magnetite grains occur in the rock.

In southeastern Fawcett Township the ultramafic rocks traversed in the drill core are described in the company reports as peridotite (Assessment Work Files). The rocks are said to be black or dark green, fine-grained and massive. Minor sulphide mineralization was described as disseminated millerite, pentlandite, chalcopyrite, pyrrhotite, pyrite and magnetite. Quartz-calcite veinlets and incipient asbestos stringers were encountered. The peridotite body in this area was found to be associated with a north-trending aeromagnetic anomaly, represented by the 800 contour on Ontario Department of Mines–



ODM9264

Photo 7–Photomicrograph of serpentinized dunite (× 20). Plane polarized light. Specimen E2-20.

Geological Survey of Canada aeromagnetic map 285G (Rev.). On the map face the 800 and 900 contours are added to show the probable continuity of this body with that in northwestern Fawcett Township.

Felsic Intrusive Rocks

Felsic intrusive rocks occupy much of central and south-central Fawcett Township where they form a large pluton referred to by the writer as the Granite Lake pluton. Smaller bodies of these rocks occur as minor irregular masses and dikes of feldspar porphyry, feldspar-hornblende porphyry, and biotite lamprophyre. These minor bodies occur near the margin of the Granite Lake pluton in the northwestern part of Fawcett Township and in the central part of Leonard Township.

GRANITE LAKE PLUTON

The Granite Lake pluton consists mainly of a coarse-grained white or pink hornblende or biotite-hornblende-quartz monzonite. A biotite-rich facies is present but this is subordinate. Neither pegmatitic nor aplitic facies were seen, but feldspar porphyry was observed within the pluton in a few cases. A well-developed foliation shown by the alignment of mafic minerals is present, but this is confined to the western part of the body, being entirely absent in the eastern part where the rock is massive. The general trend of

the foliation is N65°W and this is parallel to the trend of the folding and foliation in the enclosing metavolcanics and metasediments. The quartz monzonite extends southwards into neighbouring Olgivie Township. In central Fawcett Township the trend of the contact is southeasterly, but in western Fawcett Township, the pluton is in faulted contact with the Early Precambrian metavolcanics and the Nipissing Diabase at Granite Lake. West of the fault, in the southwestern part of the township the contact is east-west, parallel to the regional grain of the enclosing rocks. Observations at various points along the metavolcanic hornblende-biotite-quartz monzonite contact show that the pluton is intrusive, but the foliation in the metavolcanics is concordant with the major trend of the monzonite contact. Mineralization was not observed in the pluton.

A thin-section of a typical rock from the body shows anhedral quartz occurring as composite grains exhibiting strain extinction and altered feldspar as the major constituents. The feldspar, in plane polarized light, is brownish and cloudy, but between crossed polarizers most of the grains, where not too altered, are subhedral and show albite lamellar twinning. Hornblende is less plentiful than biotite, with X = pale yellow, Y = green and Z = blue-green, and occurs in subhedral to anhedral grains. The biotite is bleached, and is commonly altered to a purple birefringent chlorite. Epidote is also present with accessory apatite and opaque minerals. The rock consists of 18 percent quartz, 24 percent orthoclase, 39 percent plagioclase feldspar (oligoclase-andesine, An_{30}), biotite 12 percent, hornblende 4 percent, epidote and accessories 3 percent.

In some areas, especially where the body is intrusive into the mafic metavolcanics, the rock is pink and, leucocratic and virtually devoid of ferromagnesian minerals.

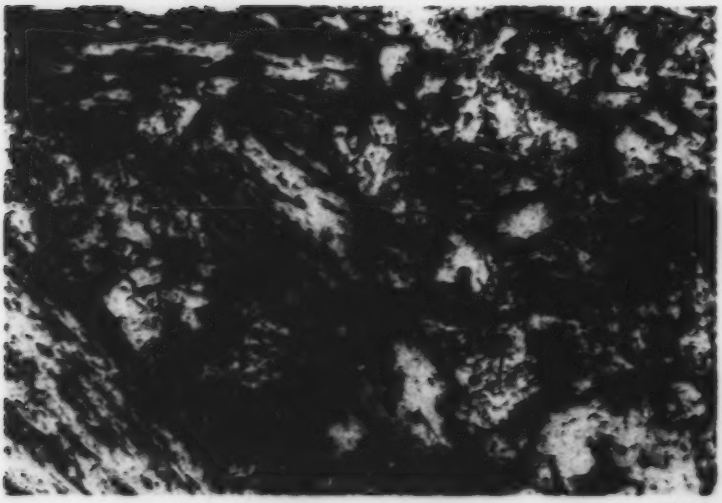
FELDSPAR AND FELDSPAR-HORNBLENDE PORPHYRIES

Near the contact of the pluton with the metavolcanics in northwestern Fawcett Township, and also in central Leonard Township, small elongated bodies of feldspar porphyry and feldspar-hornblende porphyry occur. These rocks are usually brown or sometimes grey, and show phenocrysts of feldspar in a medium-grained brown or grey matrix. Similarity between these and minor porphyritic masses in the hornblende-biotite, quartz monzonite suggests that these represent hypabyssal facies of the Granite Lake pluton. Minor pyrite and chalcopyrite were associated with these porphyries.

Photo 8 is a photomicrograph of a brown feldspar-hornblende porphyry. In hand specimen the phenocrysts are grey and average 4 mm across. These are associated with laths of hornblende up to 4 mm long and 0.5 mm wide in a brown aphanitic matrix. The thin-section shows porphyritic texture consisting of euhedral feldspar and hornblende crystals in a microgranular matrix consisting dominantly of alkali feldspar, with minor quartz grains. The feldspar phenocrysts are completely altered and appear brownish in plane polarized light. Under crossed polarizers they are seen to be altered to sericite, calcite and epidote. Some of the phenocrysts show lamellar twinning, but all the feldspars are too altered for optical determination. The euhedral hornblende phenocrysts show the following pleochroism: X = yellow, Y = green and Z = dark green. The rock consists of 2 percent quartz, 14 percent altered plagioclase phenocrysts, 20 percent hornblende phenocrysts, 54 percent altered feldspar matrix which contains the quartz, with 8 percent epidote and 2 percent of opaques and apatite.

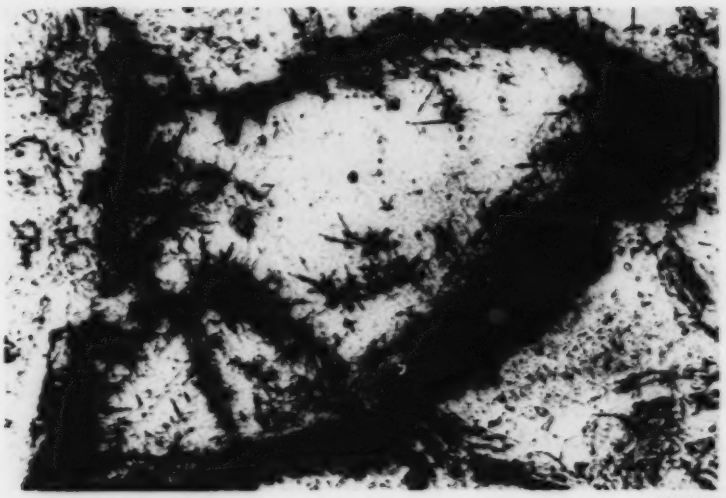
ODM9265

Photo 8–Photomicrograph of feldspar-hornblende porphyry (× 20). Plane polarized light. Specimen E1-2.



ODM9266

Photo 9–Photomicrograph of biotite lamprophyre (× 20). Plane poralized light. Specimen F14-2.



ODM9267

Photo 10–Photomicrograph of basal section of biotite showing sagenitic rutile needles in biotite lamprophyre of Photo 9 (×50). Plane polarized light. Specimen F14-2.

BIOTITE LAMPROPHYRE

A photomicrograph illustrating the texture of the biotite lamprophyre is shown in Photo 9. The rock is dark grey and medium-grained in hand specimen and shows numerous grains of biotite mica 2 mm across. In thin section the texture is porphyritic-microgranular showing phenocrysts of chloritized biotite in a sericitized and carbonatized quartzo-feldspathic matrix. The biotite phenocrysts show the typical 'battlemented' (Williams, H. *et al.* 1955, p.86) ends of lamprophyres with an opaque rim of iron-oxide due to chloritization. The latter has caused the interior to be bleached to pale green chlorite showing undulose extinction due to strain. Pleochroic haloes around zircon occur, and in basal sections sagenite webs of fine, elongated, rutile needles in three sets at 60° can be seen, especially at the edges of the flakes (Photo 10). The feldspar of the matrix is lath shaped subhedral fresh plagioclase (albite) showing lamellar twinning. The quartz occurs as irregular grains. Interstitial calcite is common throughout the section, associated with apatite and grains of iron-ore. The rock consists of 8 percent quartz, 52 percent biotite, 15 percent calcite, 6 percent albite, 9 percent sericite, and 9 percent potash (orthoclase) feldspar. The biotite phenocrysts range from 0.2 to 0.6 mm in greatest diameter.

LEUCOGRANITE

This is not a common rock type of the granitic rocks. In hand specimen the rock is pale buff and resembles the hornblende-biotite-quartz monzonite except that it is either entirely devoid of ferromagnesian minerals, or contains less than 2 percent of these. The ferromagnesian mineral is biotite. This rock type was not studied in thin-section.

EARLY TO LATE PRECAMBRIAN

Mafic Intrusive Rocks

DIABASE DIKES

Diabase occurs as dikes trending NNW, north and NNE but the vast majority comprise a parallel swarm with a general trend of N15°W in both the granitic rocks and the metavolcanics and metasediments which they intrude. The dikes vary from 1 foot to 200 feet (0.3-60 m) wide and chilled-margin contacts were often observed. The texture of the rocks varies with the size of the dikes from basaltic to diabasic. They are commonly non-porphyritic, black, magnetic, and characteristically have dark red-brown weathered surfaces. In the porphyritic varieties phenocrysts are of yellow-green feldspathic material measuring up to 7 mm by 10 mm where equant, or as elongated phenocrysts up to 4 mm by 13 mm.

A thin section cut from a fine-grained type containing the yellow feldspars shows the latter to be completely altered euhedral phenocrysts of sericitized plagioclase feldspar set in a thoroughly altered cloudy aphanitic matrix containing lath-shaped fresh augite. In some places the augite is arranged in stellate fashion. The texture of the rock is porphyritic-basaltic.

The dikes of this major swarm may be of Matachewan type, i.e., pre-Huronian in age (Miller 1923), but although there are one or two of north strike, the typical Matachewan trend, the majority have a strong NNW trend. No isotopic age dates are available for these rocks.

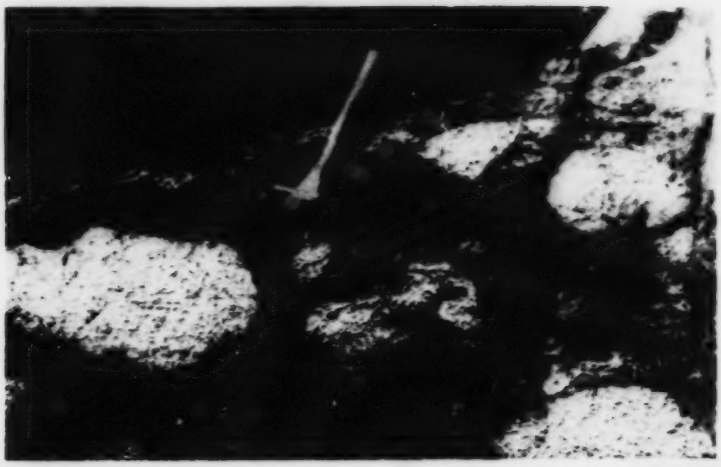
MIDDLE PRECAMBRIAN

Huronian

COBALT GROUP

Gowganda Formation

This formation occurs in the northwestern, northeastern, and central, parts of Leonard Township. Only one outcrop was observed in Fawcett Township in Shining Tree Lake. Its distribution is closely associated with that of the Nipissing Diabase. Various members

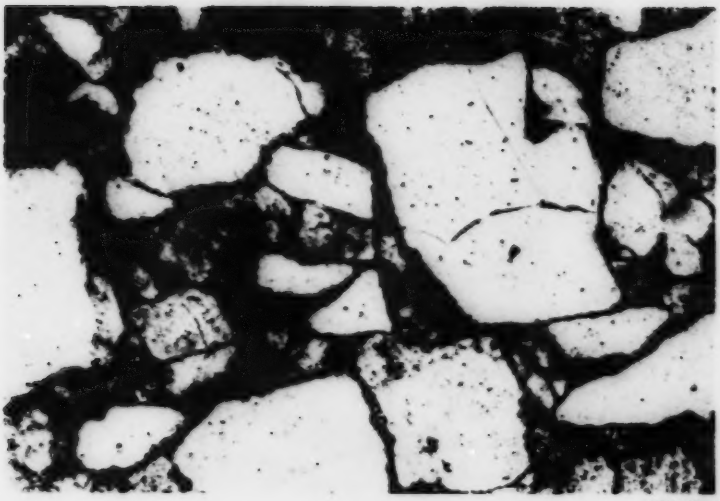


ODM9268

Photo 11–Granite boulder conglomerate, Gowganda Formation, east-central Leonard Township.

ODM9269

Photo 12–Polymictic conglomerate, Gowganda Formation, eastern shore Bobtail Lake, Leonard Township.



ODM9270

Photo 13–Photomicrograph of greywacke, Gowganda Formation (× 20). Plane polarized light. Specimen F14-12.

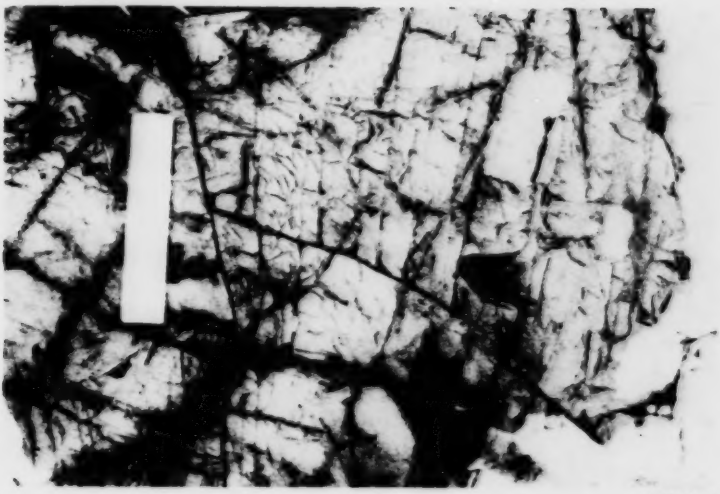
are present in the map-area, the most important being a polymictic conglomerate and an argillite.

The polymictic conglomerate member is best exposed west and southwest of Bobtail Lake in northwestern Leonard Township, and in east-central Leonard Township. It consists of subangular and rounded cobbles and boulders of granite, gneiss, schist, iron formation and felsic metavolcanics, set in a pink sandy matrix of quartz and feldspar (Photos 11, 12).

Argillite and paraconglomerate are exposed to the east of the conglomerate in northwestern Leonard Township and within the limits of the map-area are the main rock types east of Slim and Irene Lakes in Leonard Township. The paraconglomerate consists of sparse massive pink pebbles of granite set in an argillaceous matrix.

A well exposed rhythmite (Flint 1971, p.400) formation occurs ¼ mile (0.4 km) south of the southwestern tip of Mullen Lake along the eastern side of the Hydro-Electric Power Commission road. This is a flat lying unit consisting of alternating layers of very fine grained, dark grey mudstone extremely regularly interbanded with pink fine-grained silty laminae. The mudstone layers are 8 mm thick, the silt layers 2 mm thick.

Greywacke, siltstone and pink arkose are also present in the Gowganda Formation and in one case the arkose contains a carbonate cement. A photomicrograph of a thin section of the greywackes from this unit is shown in Photo 13. In hand specimen the rock is dark greenish grey, medium-grained and shows grains of quartz and feldspar. In thin-section the characteristic microbreccia texture of greywacke is evident. The rock consists of quartz (36 percent) and feldspar 21 percent) in a sericitic argillaceous matrix forming 41 percent of the rock. The feldspars are both alkali feldspar (orthoclase) and plagioclase feldspar (albite, An_4) and are angular, subrounded and rounded. Secondary quartz and chlorite (2 percent) are associated with the sericite in the matrix.



ODM9271

Photo 14–Worm-like impressions in siltstone, Gowganda Formation, southwest shore of Mullen Lake, Leonard Township.

ODM9272

Photo 15–Regular and irregular annular impressions in siltstone, Gowganda Formation, southwest shore of Mullen Lake, Leonard Township.

On the southwestern shore of Mullen Lake at an outcrop about ¼ mile (0.4 km) from the extreme southern end of the lake are found curious worm-like (Photo 14) and irregular annular (Photo 15) structures varying from 2 mm to 15 mm across and consisting of red silty material resembling worm borings. The central part of the annular structures are usually weathered out, and the cavities are cylindrical and cross-cut the bedding. This increases the resemblance of these structures to worm borings. They occur in dark grey siltstone.

Lorrain Formation

This formation occurs southeast of Shining Tree Lake with a lower and upper part separated by a Nipissing Diabase sill. At one point along the eastern shore of the lake a dip of 5° south was recorded and from the disposition of outcrops and contact relationships with the diabase, the strata appear to be dipping inwards in all directions, forming a shallow basin-type structure.

The rocks consist of well-sorted pink, cream and white arkose and quartz arenite, varying from course- to medium-grained. In some cases the coarser varieties have clasts 2 mm to 4 mm across and are magenta coloured. These rocks were not seen in contact with the Gowganda Formation, but they overlie a Nipissing Diabase sill which itself overlies rocks of the Gowganda Formation as observed at Mullen and Spud Lakes. They are therefore younger than the Gowganda Formation and because of this and their lithological character, they are classed as Lorrain Formation by the writer.

MAFIC INTRUSIVE ROCKS

Nipissing Diabase

Nipissing Diabase occurs throughout the map-area but it is better represented in Leonard Township than in Fawcett Township. It occurs predominantly as sills and small remnants of sills. The largest outcrop area occurs in western Leonard Township.

In the map-area to the west of Wapus Creek, in Leonard Township, the formation is represented by two sills: a lower sill resting on the Early Precambrian metavolcanic-metasedimentary sequence and on Gowganda Formation, and part of an upper sill exposed southeast of Shining Tree Lake and intruded within the Lorrain Formation. The lower sill is believed to be generally flat lying, and the upper sill to be saucer shaped, with inward dips. East of Wapus Creek, a sill is emplaced in Gowganda Formation sediments. This sill, in contrast to the lower sill in western Leonard Township, dips eastwards at about 50° and strikes WNW concordantly with the sediments. This eastern sill may be in part funnel-shaped in the manner proposed by Lovell and Caine (1970) and could represent the feeder for the subhorizontal sills to the west. Confirmation of the east dipping attitude of this sill was available from mapping carried out previously in Tyrrell Township immediately to the north (Carter 1972b).

Although the diabase contains different facies, the commonest type is a medium-grained, mottled black-and-white ophitic rock of fresh aspect. The pyroxene is subhedral and black, and the feldspar is usually pale green. Pyrite is usually present in amounts of about 2 percent.

Some phases of the diabase are quartz-bearing, usually fine-grained, altered, and contains pyrite up to about 2 percent. It is distinctly greener in colour than the fresher facies and may contain irregular areas of white calcite. Chalcopyrite is often present in amounts of about 3 percent. Another facies occurring sporadically, is a coarse-grained amphibole-gabbro. In this variety the hornblende may be up to 10 mm long by 5 mm wide and is associated with white feldspar phenocrysts as much as 20 mm long and 10 mm wide. This variety does not show any mineralization.

Pink granophyric differentiates are also present in the diabase. It appears to be a culmination of a trend of increasing coarseness of grain and feldspar content in the diabase. In an earlier phase of this diabase-granophyre sequence, the ferromagnesian material occurs as long bladed or acicular grains set out in a pink equigranular feldspar base. This variety grades into rocks in which the ferromagnesian material decreases, giving place to red, chloritized and epidotized amphibole-syenites of coarse or medium grain. The end product of this process is a pale pink leucocratic rock of medium to coarse grain, which may be completely devoid of any ferromagnesian material (see also Collins 1913b, p.63, 66 and 70 re Aplite; and Collins 1917, p.90, under Differentiation). A thin-section cut from this rock shows sericitized laths of plagioclase (where fresh consists of albite, An_4) surrounded by granophyric quartz-feldspar intergrowths. Accessory calcite is present. The rock contains about 2 percent chalcopyrite as disseminated grains. In some cases this granophyric material is closely associated with inclusions of sandstone from the Gowganda Formation, and some of the granophyres are believed to be derived by sandstone assimilation (see also Collins 1917, p.90, under Assimilation). The origin of this granitic material has been the subject of a B.Sc. thesis by the senior assistant on this survey (Fraser 1973).

During the mapping a marked increase in the content of pyrite, chalcopyrite, and cobalt mineralization was seen to be associated with the differentiation of the diabase towards the granophyre end product. The chalcopyrite may attain a concentration of 5 percent. Cobalt bloom and calcite also accompany the chalcopyrite and granophyre. This characteristic was also discussed by Collins (1917, p.120; 1913b, p.104, under Genesis) who refers to the granophyre as aplite. The distribution of feldspathic diabase and granophyre or syenite, shows a marked positive correlation with areas which have been actively explored and with the occurrence of quartz or quartz-calcite veining. It is believed that the differentiation of the diabase is associated with this mineralization, a view which is in harmony with the hydrothermal origin of the silver/cobalt mineralization. The transformation of pyroxene to amphibole to produce amphibole granophyres and syenite also supports this conclusion because of the increase of water concentration and development of more acidic plagioclase and crystallization of potassic feldspar as differentiation progresses, leading to deuteric alteration. It is therefore recommended that exploration activity for silver/cobalt mineralization be concentrated in those areas of the diabase where it has been differentiated to granophyre. A study of the nature of this differentiation would provide an exploration tool for such mineralization.

Phanerozoic

CENOZOIC

Quaternary

PLEISTOCENE AND RECENT

The Cenozoic is represented by Quaternary deposits comprising sand, gravel, muskeg and alluvium. These deposits together cover about half the total map-area.

Gravelly till occurs in patches on higher ground and can be seen along the Bay Lumber and the Hydro-Electric Power Commission roads. The boulders consist predominantly of granitic and volcanic rocks. These deposits are most numerous along the northern half of the Bay Lumber Road in Fawcett Township, where they occur as glacial end and interlobate morainic material (Boissoneau, A.N., 1965).

Sand comprises the most voluminous glacial material and is represented by large areas of white and pale brownish sands throughout central and southern Fawcett Township and southern Leonard Township. In the southern parts of both townships the sand forms wide flat areas consisting of glaciolacustrine deposits (op. cit., 1965), and can be seen along the southern parts of the Bay Lumber and Hydro-Electric Power Commission roads. In southeastern Leonard Township however, these deposits form hills up to 1,300 feet (400 m) high. Drilling records (Assessment Work Files) indicate that the thickness of the sand deposits ranges from about 30 feet (9 m) to about 130 feet (40 m) in southeastern Fawcett Township.

Muskeg occurs in areas of variable size scattered throughout the two townships: around the edges of lakes, along the larger streams, and in depressions between the lakes and streams (ODF Publication 1971a, b).

Alluvium occurs along the major streams such as West Montreal River, Sandstrum Creek and West Wapus Creek (ODF Publication 1971a, b).

STRUCTURAL GEOLOGY

FOLDING

Early Precambrian Metavolcanic-Metasedimentary Sequence

Structural and stratigraphic information used in determining the fold pattern and the disposition of anticlines and synclines was derived from the shape of pillow structures in mafic and intermediate volcanic rocks, banding in iron formation and the occurrence of graded bedding, flame structures, ripple marks and the bending of laminae under large clasts in tuffaceous sediments. Drift cover in the middle of Fawcett Township and the southern half of Leonard Township made it difficult to trace the structures continuously.

Fawcett and Leonard Townships

Three anticlinal fold axes were identified in northwestern and western Fawcett Township. Evidence for a synclinal axis in northwestern Fawcett Township close to the Granite Lake stock was also obtained. The fold axes trend N55°W in the northwestern part of the township but on the basis of the attitude of pillows in eastern Fawcett Township and the occurrence of volcanic rocks in drill holes, it is considered that the fold axes swing more southerly in the southeastern part of the township to assume a NNW trend conforming to the contact of the Granite Lake pluton. Drill hole data from Assessment Work Files in southeastern Fawcett Township indicate a N-S strike for the metavolcanics as interpreted in company reports. This regional trend in Fawcett Township is subparallel to the trend shown on the aeromagnetic maps for the area although the trend shown by these maps is consistently more northerly in northwestern Fawcett Township than that shown by the rock attitudes.

Eastwards into northern and central Leonard Township the rocks dip and face consistently eastwards but are overturned to the west. The axis of folding cannot be determined precisely as its likely position is occupied by overlying Middle Precambrian rocks. In northern Leonard Township the formations strike N20°W but in the central part the strike is east.

Huronian

These rocks are best exposed in Leonard Township in the western and eastern parts. Two formations are present: a lower, Gowganda Formation, and an upper, Lorrain Formation. In the Gowganda Formation in northwestern Leonard, a curved synclinal axis occurs between Bobtail and Mullen Lakes. The axis trends N35°E at the northern part of the structure but towards the south it swings through a N-S direction to assume a N55°W trend at the southern end of Mullen Lake. The southerly extension of this axis is hidden by the overlying Nipissing Diabase, but where the Gowganda is again exposed, possibly as a window or raft in diabase between Taylor and Eliza Lake, a northerly strike and westerly dip were observed. If this is taken to represent the continuation of the eastern limb of the syncline, the synclinal axis will lie to the west beneath the diabase. The rocks commonly dip 10° in northwestern Leonard Township area, but locally steep dips from 75° to vertical can be observed. The steep dips reflect local soft-sediment disturbances or faulting. In the eastern part of the township the rocks are homoclinal striking N10°W. They dip and face east. This trend of strike is also parallel to the trend of the contact of the Gowganda Formation with Nipissing Diabase. The dip angles are between 50° and vertical.

The Lorrain Formation occurs only in southwestern Leonard Township. Structural data are absent except for one measurement indicating a gentle dip of 5° southwards, and strike N70°E. From the distribution pattern of the rock types and contacts, the author suggests that an elongated basin structure exists with the axis aligned in a N-S direction.

Nipissing Diabase

This formation occurs extensively in the map-area but is best exposed in Leonard Township.

In Fawcett Township it is assumed by the author to have formed a flat-lying sill covering all the previous formations. The outcrops of diabase are therefore interpreted to be remnants of a sill.

In western Leonard Township diabase was in many cases observed to overlie the Gowganda Formation, but also to lie at the junction between the Gowganda and the Early Precambrian basement. It is believed that this diabase belongs to one sill, however, which encloses part of the Gowganda Formation. It was inferred from the distribution of outcrops in southwestern Leonard that diabase is intrusive into the overlying Lorrain Formation which overlies the sill just described as well. From these facts it is believed that there are two sills in the area. In eastern Leonard Township the diabase is a sill dipping eastwards concordant with the Gowganda Formation. The large remnant of diabase in south-central Leonard is regarded as part of the lower sill.

Faulting

Evidence for faulting in the map-area was based on the occurrence of lineaments on air photographs, shearing, stratigraphic relationships and the study of aeromagnetic contours.

Two major faults were located in the map-area: the Michiwakenda Lake Fault and the Jess Lake Fault. The former occurs in western Fawcett Township, the latter in northeastern Fawcett Township and southwestern Leonard Township. Both are extensions of the faults previously mapped in Macmurchy Township to the north (Carter 1972a). Other smaller faults are the West Montreal River Fault (in Fawcett Township) and the Spider Lake, the Soot Creek, and the West Wapus Creek Faults in Leonard Township. The two major faults are parallel, strike N15°W, and cross the entire length of the townships. On the basis of displacement of the northern contact of the Granite Lake pluton on either side of the Michiwakenda Lake Fault, and displacement of fold axes in basalt about the Jess Lake Fault in eastern Macmurchy Township (Carter 1972a) these faults are regarded as left-lateral wrench faults. Horizontal offset on the Michiwakenda Fault in the map-area is 3½ miles (5.6 km). There is also a subvertical component of the movement on the Michiwakenda Lake Fault shown by the plunge of slickensides in the quartz monzonite, which is between 30° and 50° west. All the other smaller faults except the West Wapus Creek Fault are parallel or subparallel to the major faults and may be wrench faults also, with the exception of Spider Lake Fault, which, from evidence in Tyrrell Township (Carter 1972b) to the north, is a gravity fault with downthrow to the west. It is probable that this fault bifurcates towards its southern end producing a horsetail pattern to explain the trend of the northwestern shores of Mullen, Herron and Taylor Lakes. Conclusive evidence for this was not obtained, but shearing in a northeasterly direction along the northwestern shore of Herron Lake is suggestive. The West Wapus Creek Fault trends N10°E and on the basis of structural and stratigraphic relationships, is considered to be a gravity fault with downthrow to the east. As these faults cut Nipissing Diabase, the youngest formation, the faults were active in post-Nipissing Diabase time.

Foliation

Foliation is well developed in the Early Precambrian rocks in northwestern Fawcett Township and also in the western part of the Granite Lake pluton in the vicinity of the Michiwakenda Lake Fault. The foliation is indicated by the planar habit of hornblende in the metamorphosed basalts, the planar arrangement of quartz and feldspar grains in the associated metamorphosed sediments, and flattened feldspar ovoids in a hornblende-feldspar schist. In northwestern Fawcett Township the trend of the foliation is consistently N60°W, subparallel to the trend of folding in the Early Precambrian rocks and parallel to the trend of the northern margin of the Granite Lake Stock. In southwestern Fawcett Township, the trend of the foliation is E-W, parallel to the general trend of the northern boundary to the pluton in this part of the township. The orientation of this foliation can be seen to be associated with the pluton, foliation being almost entirely absent north-east or east of the immediate border of the pluton. This is observed on both sides of the Michiwakenda Lake Fault. The Granite Lake pluton is known to be intrusive on the basis of field evidence, which supports the contention that the foliation is caused by the intrusion of the pluton. This fact is further supported by the parallelism of the foliation with the contact of the pluton. The nature of the foliation in the pluton is not entirely clear. Its spatial association with the fault could indicate a dependence on fault movements. It may also be a primary feature of the pluton but its absence throughout the border region of the pluton, especially in the eastern part, indicates that this may not be the case.

Shearing

Shearing is a minor feature of the area, and is of local significance only. It is best developed in northeastern Fawcett Township, west of the northern end of Shining Tree Lake. The shearing trends E-W and cuts both Nipissing Diabase and the Early Precambrian metavolcanics. This shearing could represent local faulting in the Nipissing Diabase.

ECONOMIC GEOLOGY

History of Exploration

Economic interest in the two townships stemmed from the recognition of favourable geological conditions in the area: Nipissing Diabase in Leonard Township for silver mineralization, and Early Precambrian metavolvanic-metasedimentary rock for gold mineralization in Fawcett Township. The occurrence of iron formation in Leonard Township also stimulated prospecting for iron. Although the central part of Leonard Township is underlain by metavolcanics and metasediments, little attention was paid to exploration for gold there; this is only partly explained by the extensive drift cover in the southern half of the potential outcrop area of these rocks. The main reason is considered to be geological; the lack of proximity of intrusive granite. In both townships

exploration activity will be hampered by the extensive drift cover, which blankets about 50 percent of the map-area.

In Leonard Township exploration activity began in 1908 when staking commenced. Silver was first found in 1909 in the form of the native metal on the claims of the Seville Prospecting and Exploration Company Limited. Considerable exploration effort followed and continued during the period 1909-1927. After this time interest declined, but was revived in 1955, and continued intermittently until the present. Most of the activity was for the locating of silver deposits. Exploration for iron ore occurred only between 1910-1911 in the Fournier Lake area, iron ore having been first discovered there in 1910.

In Fawcett Township staking began in 1918 when Burke, Landagne, Cochrane and Bullock staked a group of claims at Granite Lake near the mouth of Papoose Creek in the northwest of the township. Exploration for gold was centred in this area and continued intermittently until the present time. Gold was first found in the region in 1918 or 1919. From 1966 onwards exploration activity was extended to the southeastern part of the township initially for gold, but latterly for nickel and asbestos. Little work was carried out in the northern, central or southern parts of the township because of heavy drift cover and the occurrence of granitic bedrock. In the northeastern part of the township some exploration was carried out for silver mineralization because of the occurrence there of Nipissing Diabase. Although metavolcanic rocks are also exposed there, little recorded prospecting for gold was noted. In the writer's opinion, this is because of the absence of proximal intrusive granite, as was the case for Leonard Township.

Character of Deposits and Recommendations to Prospectors

GOLD

Gold occurs in quartz veins in fractures and shears in the Early Precambrian metavolcanics and metasediments. The most important deposit is on the Burke Showing at Granite Lake near the mouth of Papoose Creek in northwestern Fawcett Township. In this area the 'vein occurs in a fracture which cross-cuts the altered pillow lava and rusty carbonate schist at about right angles' (Hopkins 1920, p.48). A 'rough sample' taken from the dump at the prospect 'yielded $2.00 in gold per ton' (gold at $23.42 1920 price, Hopkins 1920, p.48).

Prospecting in this area by Voyager Explorations Limited indicated 'Numerous showings of native gold.' (Assessment Work Files). To the northeast and within a mile (1.6 km) of the quartz monzonite metavolcanics contact, trenching on the Jonsmith Mines Limited property in the metavolcanics gave material which 'assayed 0.98 oz. of gold per ton across a three foot [1 m] width, and other assays gave 0.7 oz. and 0.5 oz. respectively, also across three feet [1 m]' (Northern Miner 1971a, p.18). Within this area the metavolcanics are cut by minor masses and dikes of granitic feldspar porphyry, granite-pegmatite and quartz veins. In southeastern Fawcett Township on the R.G. Ramsay property, quartz veins do not crop out but exploration activity indicated cross-fractures and carbonatized shears in the Early Precambrian metavolcanics. Gold mineralization was observed in the fractures. Thus, in both the Jonsmith Mines Limited and R.G. Ramsay properties, gold mineralization occurs within a mile (1.6 km) of the intrusive quartz monzonite-metavolcanics contact. In the case of the L. Burkett property,

near the west-central boundary of Fawcett Township, even though the quartz monzonite and metavolcanics are in faulted contact, foliation is present in the latter. This foliation was observed to be spatially and genetically related to the quartz monzonite metavolcanics contact. On the basis of these observations and knowledge of the gold deposits in the southwestern part of neighbouring Macmurchy Township, it is concluded that the gold mineralization in Fawcett Township is genetically and spatially related to the Granite Lake pluton. It is therefore recommended that the quartz monzonite-metavolcanics contact zone be prospected for gold mineralization, emphasis being placed on the fracture pattern.

IRON

Within the map-area iron deposits comprise oxide facies, Algoma-type iron formation (Gross 1965, p.90-91). The most important deposit is on the McVittie-Bennett property located east and southeast of Fournier Lake in central Leonard Township. This deposit was explored in 1910-1911, and is co-linear with the A. Decker deposit lying between Fournier Lake and Bing Lake. In northwestern Leonard Township two smaller bodies occur, one about ½ mile (0.8 km) west of Bobtail Lake and the other about ¼ mile (0.4 km) northwest of Spider Lake. In all these the iron formation is concordant with the enclosing metavolcanics and metasediments and consists of hematite, magnetite, jasper and black chert, with associated pyrite in the case of the occurrence north of Fournier Lake. The observed association with the metavolcanics and metasediments indicates a genetic relationship with the volcanicity. In all these occurrences the outcrop width does not exceed 200 feet (60 m) and they are either steeply dipping or overturned. The most important deposit, the McVittie-Bennett deposit at Fournier Lake (formerly Wapus Lake) showed 'a large tonnage of ore . . . (assaying) . . . iron 40.63 percent' (ODM Publication: Report of the Iron Ore Committee, p.211-212, 1923). This deposit correlates with an aeromagnetic high on Ontario Division of Mines-Geological Survey of Canada aeromagnetic map No.284G (Rev.), in an area underlain by metavolcanics and metasediments, and it is suggested that exploration for such deposits should be restricted to these rocks.

SILVER AND COBALT

These two metals occur together in deposits spatially associated with Nipissing Diabase. his formation occurs in both townships, but it is more abundant in Leonard Township, and thus most prospecting has occurred there. The characteristics and habit of the deposits were described by Collins (1913b), Stewart (1913b) and Langford (1927) during the period when they were available for examination. The silver-cobalt deposits are quartz-calcite vein-type occurrences, and the most detailed general study was made by Collins (1913b). Descriptions by Stewart (1913b) and Langford (1927) are pertinent to the map-area. Stewart (1931b, p.189-190) described the deposits thus:

> The silver-bearing veins occur in the Nipissing diabase, although similar veins have been located in the agglomerate and conglomerate. The veins occupy distinct vertical fissures that have a general strike of north thirty to forty degrees east (magnetic). Some east and west fractures occur in the diabase, but these are generally mere cracks.

Numerous veins occur on many of the properties, but the majority of them will average only a few inches in width. Large veins, four to eight feet [1.2-2.4 m] wide in places and extending across two or three adjoining claims, are a rather marked feature of the area.

Calcite and quartz constitute the chief vein filling materials. The quartz is found frequently in a thin layer on the walls, and the calcite, usually of a white and coarsely crystalline variety, especially in the larger veins, fills the remainder of the fissure. The weathering of the calcite has formed cavities many feet in depth in several of the veins, and in some places practically all the calcite has been dissolved out to a depth of several feet for some distance along the vein. Copper pyrites, smaltite, niccolite, native bismuth, galena, and cobalt bloom are the associated minerals in the veins.

Native silver was seen on five claims. The quantity in every case was small, and the silver-bearing veins are narrow. The silver occurs in the calcite and quartz. It is also found in the black muck-like material that collects in the weathered-out cavities in the calcite. No silver, as far as the writer could ascertain, has been found in the large veins, although no evidence was obtained to show that the large ones were not contemporaneous with the smaller veins.

Later, in 1926, Langford (1927, p.94) visited the area and described the mineralization thus:

The silver-bearing veins occur chiefly in the Keweenawan diabase sill near the upper contact, and occupy vertical fissures running in directions which range from north to N.40°E. They vary in width from knife edges up to several feet. The widest seen was a stockwork, on the west shore of Nellie [Taylor] Lake, which has a width of six feet [2 m].

The filling of the fissures, which occured [sic] shortly after the intrusion of the diabase, took place at two periods synchronous with the faulting. The first filling was chiefly calcite with some quartz. Many of the large veins were filled at this time and can be recognized by the coarsely crystalline white calcite and comb quartz. The second filling was of grey or pink calcite accompanied by quartz, silver, niccolite, chalcopyrite, smaltite, and bismuth. These later-filled veins are usually narrow (less than one foot) [30 cm] and the pink or grey calcite is medium grained. In some cases they consist of two or three inches [5 or 7 cm] of solid niccolite and smaltite. The silver occurs as small flakes or scales in cracks in the calcite, or adhering to the diabase walls.

The first vein-filling occurred after the first faulting and before the second faulting, while the second vein-filling followed the second period of faulting. For this reason the metal-bearing veins may cut either the diabase or the large, coarsely crystallized veins. On the Archibald claim, silver-bearing veins also cut the diabase at right angles to the general direction of faulting.

During the current mapping project the writer noted a marked spatial association of silver-cobalt veins with feldspathic diabase (particularly the coarser types) and the granophyre facies of the Nipissing Diabase. This characteristic was also noted by Collins (1913) who referred to the granophyre as aplite, and who had made a detailed study of silver-cobalt mineralization. In areas where the diabase is fresh and not markedly feldspathic, mineralization was absent. Accordingly, feldspathic and granophyric facies have been coded separately on the map. It is therefore recommended that such areas be selected as primary regions for detailed prospecting for silver mineralization. In the mapping, two diabase sills have been observed, the upper of the two being enclosed by the Lorrain Formation of the Cobalt Group. The lower contact of the lower sill rests on the Gowganda Formation of the Cobalt Group and its upper contact lies below the Lorrain Formation. If the mineralization is mainly restricted to the diabase contacts, and the silver-cobalt deposits are independent of the enclosing rocks, then the preserved parts of the upper and lower contacts of the sills will be especially favourable. In the area southeast of Shining Tree Lake, such preserved parts of the upper sill will underlie the Lorrain rocks and could be an important prospecting area.

Fawcett and Leonard Townships

Description of Properties, Deposits and Explored Areas

In the following section all references in the text to Assessment Work Files, refer to the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake.

GOLD

Amax Potash Limited (1)

In 1972 Amax Potash Limited held four claims numbered L308812, L308813, L308816, and L308817, in northwestern Fawcett Township. No assessment work has been filed for the property, which is underlain by rhyolite, basalt and quartz arenite of the metavolcanic-metasedimentary sequence.

M. Barbour (2)

During 1972 M. Barbour held a surveyed leased claim, TRS2748, in northwestern Fawcett Township. No assessment work has been filed for the property, which is underlain by Nipissing Diabase and Early Precambrian dacite.

L.H. Burkett (3)

During 1972 L.H. Burkett held 16 contiguous unsurveyed claims in west Fawcett Township at Granite Lake, numbered: L341263-341270, L341281-341282, and L342354-342359. These claims included properties formerly known as or held by: Granite Creek (1921), Prospector Airways Company Limited (1950), and Voyager Explorations Limited (1961).

Exploration work on the property commenced in 1918 with the staking of claims TRS3767 and TRS3786 by Burke, Landagne, Cochrane and Bulloch on the west shore of Granite Lake about the mouth of Papoose Creek. Hopkins (1920, p.48) who examined this property in 1919 described the showing (Burke Showing) as follows:

> A portion of the vein was picked up by trenching in a swamp four chains to the south of the showing at the water's edge. A 20-ft [6 m] shaft was sunk on the creek bank, from which point a cross-cut was driven towards the creek for a distance of 78 feet [23 m]. Mr. Burke stated that the cross-cut passed through 14 feet [4 m] of quartz and schist which yielded considerable gold on assay. The dump shows much mineralized schist and quartz, a rough sample from which yielded $2.00 in gold per ton. Owing to the low land it is difficult to prospect the surface. The vein occurs in a fracture which cross-cuts the altered pillow lava and rusty carbonate schist at about right angles. Hence it is in many ways similar to the Ribble vein which outcrops about two and one-half miles [4 km] to the north. The vein occurs in a fracture parallel to the Ribble vein, or it may possibly be a continuation of the Ribble, although the writer did not learn of any discovery in the intervening area.

The shaft is located about ¼ mile (0.4 km) west of Granite Lake near the mouth of Papoose Creek. By the end of 1918 it was deepened to 35 feet (10 m). Further sampling of this deposit was carried out by E.G. James in 1937, but the results of the work are not available. The shaft was later deepened to 40 feet (12 m) by Mr. Burkett (personal communication) who was sampling the showing in 1972. No assessment work has been filed by Mr. Burkett.

In 1950, Prospector Airways Limited drilled 7 holes for a total length of 1,005 feet (302 m) on their claims S55252 and S52439 located about half a mile (0.8 km) south-southwest of the Burke Shaft. The holes traversed greenstone, and pyrite, and quartz stringers were encountered. The best assay was 0.06 oz. Au/ton over 2.5 feet (0.7 m) (Assessment Work Files).

In 1960, eight claims were staked in this general area by Voyager Explorations Limited. They described their property thus:

> The Granite Lake group is largely underlain by Keewatin volcanics composed of andesite, pillowed andesite, tuff and agglomerate. Where shear or fracture zones exist, these rocks have been altered to the form of a rusty carbonate schist. The shearing in general has an easterly trend, though in the vicinity of Granite Lake, towards the east side of the property, it adopts a persistent northerly strike.
>
> Numerous showings of native gold were found but when only indifferent results were obtained in a subsequent drilling program, the work was discontinued.
> (Assessment Work Files).

This was the original Landagne Showing — a rusty carbonate shear zone exposed for 130 feet (40 m) at the surface and trending N10°W. Original sampling of unknown type on this shear returned assay values of from $3.00-$12.00 per ton in gold over widths varying from 9 feet to 12 feet (3-4 m) (gold apparently at $20.67 per oz.) (Assessment Work Files). During the drilling by Voyager Explorations Limited, three holes were sunk for a total length of 318 feet (95 m) on claim MR34693. Quartz stringers and minor pyrite were traversed by the holes (Assessment Work Files).

About ¼ mile to ½ mile (0.4-0.8 km) to the west-southwest of the Burke Shaft lay the Granite Creek Showing. This consisted of a vein 1,600 feet long by 3 feet to 7 feet wide (480 m by 1 m to 2 m) and dipping 65° south. The vein was exposed for 300 feet (90 m) at the surface and had a shaft sunk on it, 40 feet deep by 9 feet by 7 feet (12 m by 3 m by 2 m). At the bottom of the shaft a 21-foot (6 m) crosscut was driven southerly to intersect the vein. Sampling of an unknown type from cross-trenches on the vein returned gold values ranging from $3.00 to $18.00 per ton in gold (gold at $20.67 per oz.) and on the crosscut average gold assay results of $13.86 over 119 inches (300 cm) and $17.34 over 140 inches (360 cm) were obtained (gold at $20.67 per oz.) (Assessment Work Files). Three other parallel veins occur near the shaft varying from 250 feet to 500 feet (75-150 m) in length. The showing occurs in an area underlain by intermediate volcanic rocks and Nipissing Diabase.

I.B. Clarkson (4)

In 1972 I.B. Clarkson held one leased, surveyed claim, number TRS2406, in northwestern Fawcett Township. No assessment work is filed for the property. The property is underlain by Early Precambrian intermediate metavolcanics.

Jonsmith Mines Limited (5)

During 1972 this company held a group of 4 claims numbered L282183-282185 in northwestern Fawcett Township.

The claim group is underlain by an interlayered sequence of metabasalt, meta-rhyolite, and arenaceous metasediments folded about a synclinal axis trending N60°W and intruded by granite-pegmatite, feldspar porphyry and quartz veins. Chalcopyrite and secondary malachite were observed in the pegmatite, quartz veins and metasediments by the writer. The area was trenched and the deposit 'assayed 0.98 oz. of gold per ton across a three-foot [1 m] width and other assays gave 0.7 oz. and 0.5 oz. respectively, also across three feet [1 m]. The showing is described as 'not large' . . .' (Northern Miner 1971a, p.18 (770)).

Midrim Mining Company Limited [1966] (6)

During 1966 Midrim Mining Company Limited held under option a group of 53 contiguous unsurveyed mining claims, the southern part of which was located in the extreme northeastern part of Fawcett Township between Foley Lake and Shining Tree Lake. The claims were numbered MR41447-41496, MR43415-43417, but only 9 claims: MR41452-53, MR41465-67, MR41478-79, MR41489 and MR41494 were located in Fawcett Township. The claims were not in good standing in 1972.

The company carried out a ground electromagnetic survey in 1966 over the group and detected 11 weak conductors one of which was in Fawcett Township. This conductor was 500 feet (150 m) long, and trended N60°W. It was located near a diabase dike (Assessment Work Files). The company recommended that the conductive zones should be further checked by another electromagnetic method for the possible occurrence of disseminated sulphide mineralization.

The portion of the claim group in Fawcett Township is underlain by Early Precambrian intermediate metavolcanics and Nipissing Diabase. It is crossed by the Jess Lake Fault.

No further work was filed for the property which was allowed to lapse.

R.G. Ramsay (7)

During 1972 R.G. Ramsay held 21 unsurveyed contiguous claims in southeastern Fawcett Township. This property included claims formerly held by Ogilvie Syndicate (in 1966) and later by Raylloyd Mines and Explorations Limited (1967-71), after which time they were allowed to lapse.

Initial interest in the area was due to the observation on regional aeromagnetic maps of an 'elongated discrete... aeromagnetic feature peaking over a small lake on the common boundary between Fawcett and Ogilvie Townships... of about 800 gamma relief...' and extending northwards and northwestwards, occurring in an area thought to be underlain by Early Precambrian metavolcanics (Assessment Work Files). The anomaly had 'an indicated length of 7000 feet [2100 m] and a width of about 1,200 feet

[360m] at the widest part' (Northern Miner 1971b, p.5 (1053)). Its trend 'suggested a conformable relationship to the contact of a granite mass lying to the west.' Because of this the feature was considered to hold promise 'of a segregated magnetite emplaced in older volcanic rocks,... [and]... accompanying base and precious metal mineralization... [or] a weak bedded iron formation... offering the further possibility of conformable sulphides in facies changes.' (Assessment Work Files).

Accordingly, in 1966, ground magnetic and electromagnetic surveys were undertaken by Ogilvie Syndicate. These surveys confirmed the main anomalous trends and delineated three main peaks of the aeromagnetic anomaly. Evidence 'for structural cross-breaks in at least two, possibly three places, and for a geological contact setting to the main linear' (Assessment Work Files) was obtained. It was concluded that the magnetic activity was 'derived from a weak magnetite iron formation' (Assessment Work Files) but because of the absence of notable conduction conformable to the setting of the magnetic linear 'bedded sulphides therefore do not appear probable on the property' (Assessment Work Files). Conduction was, however, observed in the cross-breaks and this was considered to imply fracture-controlled mineralization indicating that 'the greatest potential was... with gold-bearing sulphides... occurring as fissure material...' (Assessment Work Files). Accordingly, three drill holes were recommended to test the conductors. One hole was drilled at the western shore of the southern part of South Sandstrum Lake for a depth of 504 feet (151 m) (Assessment Work Files). It intersected peridotite, andesite and diorite, with pyrite, chalcopyrite, sphalerite and gold mineralization and accompanying graphite.

In 1967 Raylloyd Mines and Explorations Limited sank 5 diamond drill holes for a combined length of 2,865 feet (860 m) in the area about ½ mile (0.8 km) south of South Sandstrum Lake (Assessment Work Files). Peridotite, diorite and mafic to felsic metavolcanics were encountered. Traces of gold and silver were obtained on assay and the best copper assays were 0.82 percent Cu over 0.7 feet (0.2 m) and 0.47 percent Cu over 2.5 feet (0.7 m) (Assessment Work Files). Pyrite and chalcopyrite were located in the meta-rhyolite. These assays were from a hole drilled in the neighbourhood of the main cross-break. Later in the year, another ground electromagnetic survey was carried out by the same company on a contiguous group of claims ½ mile (0.8 km) to the southwest near the West Montreal River. 'Two weak conductors were located during the survey. Both [were] 400 feet [120 m] long . . .' and their strike was 'north-south coincident with the trend of the rock in the area, and [were] approximately 1,200 feet [360 m] apart and in line with each other' (Assessment Work Files). Two drill holes were sunk for a total length of 862 feet (259 m) to test the conductors. The northerly conductor was found to consist 'of a narrow carbonatized shear zone containing sparse amounts of chalcopyrite and lying between two diabase dikes' (Assessment Work Files). The southerly conductor 'was a combination of two fractured sections containing sparse seams of pyrite and pyrrhotite' (Assessment Work Files). A vertical hole was also sunk for 233 feet (67 m), ½ mile (0.8 km) south of South Sandstrum Lake in the hope of finding asbestos in the peridotite cut in earlier drill holes. Nothing of immediate economic interest was found in this hole.

In 1968 a review of the geophysical, geological, and drilling results by Barringer Research Limited indicated that the magnetic linear reflected the occurrence of a peridotite band; that the regional geological structure indicated a NNW trend of the metavolcanics with a dip of 65° west—a result supported by magnetometer surveys; and an andesite-rhyolite contact striking N27°W. However, it was concluded that the 'geological environment coupled with geophysical and diamond drilling results, suggest that chances

are minimal of locating copper mineralization of either the porphyry type found in the Porcupine area or the massive sulphide Noranda type' (Assessment Work Files). Nevertheless, three diamond drill holes in rhyolite were recommended to check 'the lateral and vertical continuity of copper mineralization' (Assessment Work Files) located by previous work; to check the magnetic anomaly in the southern part of the property for pyrrhotite mineralization, and to assess 'its significance to the... rhyolite-andesite contact and associated mineralization' (Assessment Work Files). Three drill holes were accordingly sunk by Raylloyd Mines and Explorations Limited for a total length of 1,097 feet (329 m). Sulphide mineralization consisting of pyrite, chalcopyrite, and pyrrhotite, and magnetite and asbestos were encountered (Assessment Work Files).

In 1971 two drill holes were sunk by Raylloyd Mines and Explorations Limited to test the peridotite for nickel mineralization. The drill holes aggregated 1,255 feet (376 m) (Assessment Work Files). The first 'hole was completed at a depth of 750 feet [225 m] and intersected a core length of 470 feet [140 m] of disseminated sulphides . . .' (Northern Miner 1971b, p.5 (1053)). Partial assays from this hole showed 'low nickel content of about 0.20 percent or less' (Assessment Work Files). The nickel minerals were millerite and pentlandite. Cobalt conglomerate, peridotite and diabase were intersected in the holes.

No further work was recorded for the claim group.

IRON

J.P. McVittie and W.S. Bennett (16)

During 1972 W.S. Bennett and J.P. McVittie held six surveyed claims, numbers WD968-973 in central Leonard Township on the east shore of Fournier (Wapus) Lake, and J.P. McVittie held an additional surveyed claim WD 1051 straddling the central part of Leonard-North Williams Township boundary. The property was originally held by Mackenzie and Mann Limited in 1910.

Surface exploration in the area began in 1910 on the east side of Fournier Lake by Mackenzie and Mann Limited under the direction of A. Fournier (Collins 1917, p.125). 'Trenches were made across the range at intervals of 50 feet [15 m], exposing a main ore-body from 10 to 50 feet [3-15 m] wide, and some much smaller parallel ones. Ore was found in this manner for 4,000 feet [1200 m] along the strike . . . It was planned to do diamond drilling on the property in order to determine the character of ore-body in depth; but this was never carried out and in 1911 exploratory work was abandoned.' (Collins 1917, p.125). Since that time no work has been recorded.

Collins, who had examined the occurrence in the course of his mapping of the Onaping map-area and the Gowganda Mining Division, stated that the body was 'Keewatin iron formation' (Collins 1911, p.201) enclosed in Early Precambrian rocks which consisted of 'dull coloured, chloritic schists, that stand almost vertically and strike north and south.' (Collins 1911, p.201-202). The deposit;

> forms a ridge 350 feet [105 m] wide and 1¼ miles [2 km] long from north to south. This ridge consists of several parallel bands of iron formation alternating with chloritic and sericitic schists, the schists and iron formation striking slightly west of north and dipping 85 degrees west . . .

The iron formation is a thinly stratified rock consisting of alternating siliceous and iron-bearing layers from ⅛ to 1 inch [0.6-2.5 cm] thick. The iron-rich layers, composed of minute magnetite octahedra embedded in silica, are dark grey or black; the lean layers vary from different shades of grey to bright red.
(Collins 1917, p.124).

Certain bands or slender lenses carry enough iron oxide to be nearly black and strongly magnetic. The largest, including minor lean bands, is from 40 to 50 feet [12-15 m] wide, and persists as a succession of thin lenses for 4,000 feet [1200 m] along the strike. This rich band is crusted superficially with limonite, but a little below the surface seems to be siliceous iron formation heavily impregnated with magnetite and hematite.
(Collins 1913b, p.114).

Under the microscope the rock is seen to consist mainly of finely granular quartz, in alternate layers of which small octahedral crystals of magnetite are concentrated. Shreds of colourless secondary mica arranged along the stratification plane are fairly abundant. No clastic texture is apparent. The total amount of magnetite present does not usually exceed 15 percent.
(Collins 1917, p.124-125).

The principal ore outcrops were systematically sampled. The surface exploration and sampling indicate that there is undoubtedly a large tonnage of ore of the following average analysis:

		Percent
Iron		40.63
Silica		15.43
Sulphur		2.71
Phosphorous		0.014
Lime	approx.	7.5
Magnesia	approx.	4.0
Manganese	approx.	2.25

(ODM Publication: Report of the Iron Ore Committee, p.211-212, 1923). Selected samples were 'reported to have yielded 52 percent metallic iron' (Collins 1913b, p.114).

Shining Tree Lake Occurrence (20)

The occurrence spans the common Tyrrell-Leonard Township boundary, and lies ½ mile (0.8 km) east of Shining Tree Lake. The deposit is 100 feet (30 m) wide at outcrop and consists of red jasper, dark grey chert and magnetite, with minor pyrite. This outcrop forms part of a body which extends northwestwards into Tyrrell Township, and is about 1,500 feet (460 m) long and 150 feet (45 m) at maximum width. No exploration activity was recorded on this iron formation.

SILVER

E.B. Archibald (8)

In 1972, E.B. Archibald held three contiguous surveyed claims: GG3243, 3754, and 3755, one mile (1.6 km) south of Fournier Lake in central Leonard Township. These included the original Archibald claim, probably GG3243, described by Stewart (1913b, p.191) in 1912 viz:

The rock formation is diabase. Surface work has exposed three veins from 3 to 6 inches [7.6-15 cm] wide and having a generally north-south strike. Many smaller stringers and fissures occur in the vicinity of these veins. A small quantity of native silver was observed in one of the larger veins. Quartz and calcite are the chief vein filling materials. Small amounts of galena, copper pyrites and cobalt bloom are present.

By 1926 the property had included 7 claims and was under option to a Toronto syndicate.

A shaft was sunk, which showed silver for a depth of eighteen feet [5.5 m] over widths of six to eight inches [15-20 cm]. This silver occurred as flakes or scales in cracks in the diabase and calcite of the vein and was accompanied by chalcopyrite and smaltite. (Langford 1927, p. 97).

No other work was recorded for these claims.

Associated Porcupine Mines Limited (9)

In 1972 this company held 9 contiguous surveyed claims in northwestern Leonard Township about Spud Lake. These claims were numbered GG65, 66, 180, 181, 182, 183, 184, BG264, and 265. Only a very small part of GG66 is in Leonard Township.

This property was originally owned by McIntosh Mines Limited and later by Walker Silver Mines Limited in 1926. The original property was described by Stewart (1913b, p.192) as follows:

The prevailing formation is diabase, but areas of the underlying conglomerate and banded slate occur on several of the claims.

Just east of . . . [Spider] now Mullen Lake a vein 6 to 8 inches [15-20 cm] wide has been uncovered for several chains. The gangue is quartz and calcite, with considerable copper pyrites and cobalt bloom. This vein dips at a high angle to the west. The surrounding rock has been severely shattered and many smaller veins occur in the immediate vicinity. A shaft 65 feet [20 m] deep has been put down on this vein.

Just east of the vein described above, another vein has been located. This is a very long vein, that runs in a southwesterly direction on to B.G.264, crosses the northwest corner of Dalton Thomas' claim and appears in B.G.252 for several chains. This vein varies in width from a mere crack to 5 feet [1.5 m] in width. It dips in places at a high angle to the west. Calcite and quartz are the chief vein filling materials, but copper pyrites and cobalt bloom are abundant. Where the vein crosses Dalton Thomas' claim niccolite one inch [2.5 cm] wide occurs.

Camps have been erected on the property and a 12-h.p. boiler and hoist have been installed at the shaft. No work was in progress during the season.

The property was later acquired from Walker Silver Mines Limited by Associated Porcupine Mines Limited and in 1959 the latter drilled 3 diamond drill holes totalling 836 feet (225 m) in the neighbourhood of the shaft on the eastern shore of Mullen (formerly Spike) Lake. The property is underlain mainly by Nipissing Diabase with small areas of Cobalt sediments. Chalcopyrite and pyrite were intersected in the drilling but 'no values in gold or silver were obtained' (Assessment Work Files). No further work was filed for this property.

Caswell-Eplett Prospect [1912] (10)

This prospect comprised two claims, WD1145, and 1146, in 1912, and has since been allowed to lapse. Stewart (1913b, p. 191) described the property viz:

These claims (W.D. 1145 and 1146) are located a little west of Fournier Lake and immediately north of the claims of the Seville Exploration Syndicate. The formation is chiefly diabase, but the contact between the diabase and the Cobalt series occurs on W.D.1145. Quite extensive surface work has exposed many veins on W.D.1146. Cobalt bloom occurs in several of the veins. Small flakes of native silver were found in the black muck-like material in a small vein just west of the shaft.

The most extensive underground work in the area has been done on W.D.1146. Mining operations were not in progress when the writer was on the property, but some information regarding the underground work was obtained from Mr. Grant Caswell. A vertical shaft was sunk 100 feet [30 m] on a vein that showed silver at the surface. A cross-cut was run 100 feet [30 m] east and the same distance west from the shaft. On the east side a calcite vein eighteen inches [45 cm] wide, and a vein of niccolite 4 to 6 inches [10-15 cm] wide were crossed. A calcite vein was found on the west side of the shaft.

The plant consists of 20-h.p. upright boiler, a 5 x 5 hoist, three pumps and a Rand drill.

No further work was done on the property. Collins (1913a, p.194) stated that there was a 'group of parallel but irregular veins striking N15°E,' on the property.

Coulee Lead and Zinc Mines Limited [1963] (11)

During 1963 Coulee Lead and Zinc Mines Limited held a group of 28 contiguous claims in northwestern Leonard Township about Herron, Taylor and Bing Lakes. This region included the former property of the Nellie Lake Syndicate and the Steep-Thompson prospect, where numerous calcite and quartz-calcite veins were found (Assessment Work Files). The claim group was later allowed to lapse. Concerning the property of the Nellie Lake Syndicate, Stewart (1913b, p.191) who examined the area in 1912 wrote:

This company has a group of 19 surveyed claims located in the vicinity of Nellie [now Taylor] Lake. The chief underlying rock is diabase, but some claims in the group are located on Keewatin. Extensive surface work has been done on several of the claims and many veins have been exposed, of which some are very large. During the season a shaft 34 feet [10 m] deep was sunk on a large vein that occurs on TC730 and TC713. This vein has been uncovered for a distance of about 8 chains [160 m], and is 5 to 6 feet [1.5-1.8 m] wide in places. Its average width is probably about two feet [0.6 m]. The gangue material is calcite, but cobalt bloom, smaltite, niccolite, and bismuth in small quantities are present. The vein has almost vertical dip and strikes, in a general way, about north 25° east. No silver has been seen in this vein.

Several other shafts and test pits, varying from 20 to 60 feet [6-18 m] in depth, have been sunk on promising looking veins on these claims.

Langford (1927, p.98) examined the Steep-Thompson property in 1926 and stated as follows:

These claims G.G.5288 and 5289, are situated on Horseshoe [now Herron] Lake, and the veins seen suggest that they are an extension of the McIntosh veins. They strike N20° magnetic, and carry niccolite, smaltite, chalcopyrite, and cobalt bloom in veins of quartz and calcite.

In 1963 Coulee Lead and Zinc Mines Limited carried out a geological mapping program

'to examine the Nipissing diabase-Keewatin contact, with particular attention to structural features such as jointing and faulting, and to locate more calcite and quartz-calcite veins' (Assessment Work Files). Blasting of trenches was also carried out. The results of the geological mapping indicated:

Numerous other veins ranging in width from a fraction of an inch to four feet [1.2 m]. In many cases the narrow veins of calcite and quartz-calcite are mineralized with pyrite, chalcopyrite, galena and in some cobalt bloom is present. Some of the veins are iron stained. Visible silver was not observed . . .

Numerous veins of calcite and quartz-calcite were noted, most of which have a northeasterly strike and steep dip. Most veins are from ¼" to 4" [0.6-10 cm] in width and consist of grey and sometimes pink calcite, and varying amounts of quartz. Many are mineralized with pyrite, chalcopyrite and galena. Some of the veins and in places the diabase itself, show cobalt bloom and nickel bloom, which indicates the presence of these primary minerals.

Probably there were two periods of faulting and the metallics were injected into the later formed fissures. These would be the smaller veins.

Many narrow grey calcite veins can be seen in the diabase along the western shore of Nellie [now Taylor] Lake and the western side of the peninsula which juts out into Horseshoe [now Herron] Lake. On the western shore of Nellie [now Taylor] Lake, these veins are commonly along the joint planes and fractures in the diabase. North-south faults are apparent in the immediate area.

Faulting and columnar jointing occur along and near the Nipissing diabase-Keewatin contact and numerous veins have been observed along these jointing planes, particularly along the western shore of Nellie [now Taylor] Lake. Other veins in the immediate vicinity of Horseshoe [now Herron] and Nellie [now Taylor] Lakes are probably associated with this jointing or a second period of faulting.

Cobalt bloom is not uncommon and indicates the presence of cobalt. Pyrite, chalcopyrite, and galena minerals are a frequent occurrence.

Geological and structural conditions are favourable for the occurrence of silver.

(Assessment Work Files).

On the basis of the geological mapping it was recommended that the mineralized veins and the areas showing cobalt bloom, which were located by the mapping, be sampled by trenching or pitting.

Intensive prospecting should be done along the western shore of Nellie [now Taylor] Lake to determine whether any trenching should be carried out on the numerous veins along the jointing.

The old trenches containing cobalt bloom should be cleaned out and opened up.

(Assessment Work Files).

No further work was filed for the property.

Albert Decker (12)

During 1972 Albert Decker held one claim L297717 located in central Leonard Township between Bing and Fournier Lakes.

The claim is underlain by ryholite and oxide iron formation, and trenches have been excavated on these rocks. No results of the trenching have been given.

Explorations Projects [1959] (13)

In 1959 Explorations Projects held 12 claims in northwestern Leonard Township about Bobtail and Mullen Lakes. These claims were subsequently allowed to lapse.

Geological mapping was carried out by the company during 1958 and 1959

to study the extent of a metamorphic feature which has produced a spotted and banded alteration in the Cobalt Sediments and to examine in detail an area along the footwall contact of the Nipissing Diabase Sill, which appears favourable for the occurrence of silver, and arsenide bearing calcite veins.

(Assessment Work Files).

On the basis of the geological mapping, the conclusions were as follows:

It is assumed that the diabase sill is the genetic source of the silver arsenide bearing carbonate veins in this Cobalt Gowganda Region. Furthermore the position of known productive veins indicates that the mineralizing range of the sill is less than 500 feet [15 m] normally from the contact. Therefore, in the area west of Mullen Lake, the normal distance from the since eroded 'arch' of diabase to the present surface of the Cobalt series is quite critical. If the previously mentioned outcrops of diabase shown west of Mullen Lake represent a remnant patch of the diabase sill, and not a Matachewan Dike, this would place the Cobalt sediments in this area in a favourable horizon for the occurrence of silver-bearing veins.

All silver arsenide occurrences observed in this immediate area, by the author were found in the diabase. However, in the light of the occurrence of large numbers of rich veins found in the Huronian Sediments near Cobalt, such possibilities are being pursued in this area. Among the beds of the Cobalt series, the greywacke is considered the most favourable host because of its relative thickness, permeability, and propensity to alter.

(Assessment Work Files).

During 1959, following the geological mapping, 7 diamond drill holes were sunk for a total length of 2,206 feet (673 m) in both Cobalt sediments and Nipissing Diabase. Chalcopyrite, pyrite and carbonate stringers were intersected (Assessment Work Files).

E.L. Greave [1912] (14)

This group comprised three claims GG3507, 3508 and 3509, and were centred about 1½ miles (2.4 km) southwest of Fournier Lake in Leonard Township. They were since allowed to lapse.

Stewart (1913b, p.191) who visited the property in 1912 described it as follows:

This group of three claims is located just south of Turnbull's. Surface work was being carried on when the writer visited the property. Three veins 3 to 6 inches [7.6-15 cm] wide occur in the diabase on the most southerly claim. Small amounts of silver were seen in the three veins. The gangue material is quartz and calcite, with small quantities of copper pyrites, galena and smaltite. Surface work on the most northerly claim has exposed, two veins of quartz and calcite associated with aplitic material, but no silver had been discovered.

No further work is reported for this group. The veins were not located by the author during the present survey.

Leonard Silver Mines Limited [1912] (15)

This company held the original (1912) surveyed Turnbull claims, TC395 and 396 located about one mile (1.6 km) southwest of Fournier Lake in 1926. The property was not in good standing in 1972.

The showing was visited by Stewart (1913b, p.190) in 1912 who wrote thus:

The country rock is diabase. On one of the claims a large calcite vein has been uncovered for about three chains. This vein is 3 or 4 feet [0.9-1.2 m] wide in places. Just west of the large vein another one occurs that will average probably 8 or 10 inches [20-25 cm] in width for a distance of about three chains. The two veins have a strike of about north 30 degrees east magnetic. In the vicinity of the large veins many small stringers occur, one of which carries cobalt bloom.

No work has been filed since 1912 for the property. The veins were not relocated by the author.

Neelands Prospect [1912] (17)

In 1912 this prospect comprised claim HS448 in central Leonard Township ¾ mile (1.2 km) west of Fournier Lake. The claim was not in good standing in 1972.

The showing was visited by Stewart (1931b, p.191) in 1912 who described it thus:

This claim (HS448) lies just north of WD1146. Considerable surface work has exposed six or seven veins a few inches in width and with a strike of north to north 60° east. The formation is diabase. Quartz and calcite are the chief vein filling materials, but copper pyrites and cobalt bloom are present, and in one vein niccolite one or two inches [2.5-5.0 cm] wide occurs. No silver was seen on this property, but the writer was informed that good samples of native silver had been taken from one of the veins.

No further work is reported for the prospect.

Newnorth Gold Mines Limited [1957] (18)

In 1956 Newnorth Gold Mines Limited had staked 35 claims in west-central Leonard Township, between Mullen and Fournier Lakes and had acquired an option on two adjoining properties. The claims were later allowed to lapse.

This property included areas underlain predominantly by Nipissing Diabase and in which numerous quartz and quartz-calcite veins were located and considerable exploration work had been previously done. In 1955 five diamond drill holes were drilled by A. MacNeil for Newnorth Gold Mines Limited for a total length of 168 feet (51 m) in the area one mile (1.6 km) west of Fournier Lake (Assessment Work Files). Specks of chalcopyrite and pyrite were observed and carbonate veins varying from 4 inches to 1.2 feet (10-36 cm) were intersected. In 1956 Geo-Explorers Limited carried out a ground electromagnetic survey for the owners to locate concealed veins. Two conductors and six semi-conductors were found (Assessment Work Files). Finally, in 1957, five diamond drill holes were drilled by Cameron Diamond Drilling Company for the owners, to a combined length of 1,009 feet (308 m) in the region between Fournier Lake and Bing Lake. Calcite stringers were intersected by the holes (Assessment Work Files).

Saville Exploration Syndicate [1909] (19)

This property, located in Leonard Township about 1 mile (1.6 km) southwest of Fournier Lake, originally comprised claims HS864-874, on which silver was first found

in the area in May 1909 (Collins 1911, p.251; Stewart 1913b, p.190). The property has since been allowed to lapse.

Stewart (1913b, p.190) who visited the property in 1912 wrote:

> The holdings of this company comprise a group of eleven claims, which are situated south and west of Fournier Lake. Silver was first found in the area on this property in May, 1909. Considerable surface work has been done on the claims. Many well-defined veins occur in several places on the property. Much bloom, with smaltite, copper pyrites, and a small amount of bismuth was observed in several of the veins. No silver was found in place, but small specks were found in pieces of vein matter that had been taken out of one of the veins. The trenches are filling up again to a certain extent, so that small isolated showings of silver could easily escape detection. All the veins that were visited are in the diabase. No work was in progress on this property during the season.

Subsequent exploration was described by Langford (1927, p.96), who visited the area in 1926, as follows:

> Surface work has been carried out recently, and veins have been uncovered on claims HS864-868 and HS872-874. Silver has been reported from a number of these veins and was seen in place in one. W.F. Currie, of Toronto, now owns this group.

Since that time no further work has been recorded. The veins were not relocated by the author.

Silver Dollar Mines Limited [1947] (21)

During 1947 Silver Dollar Mines Limited held 13 contiguous unpatented claims in the extreme northwest corner of Leonard Township along the east shore of Shining Tree Lake. The claims were not in good standing in 1972.

The property was geologically surveyed in 1947 by A.D. Hellens to assess its potential for silver mineralization. No important veins were located nor were any important structural indications observed to warrant further exploration (Assessment Work Files). Bedrock on the property consists of Early Precambrian metavolcanics and Nipissing Diabase.

Silver Pack Mines Limited [1965] (22)

During 1965 Silver Pack Mines Limited held a group of 38 staked and optioned claims in the northwest part of Leonard Township between Mullen and Bing Lakes. The group was divided into a northerly section and a southerly section. This property included the former property of the Nellie Lake Syndicate (for a description of which, see under Coulee Lead and Zinc Mines Limited (8), and the Steep-Thompson prospect (claims GG5288 and 5289) along the western shore of Herron Lake (for a description of which see also (8)). The claims have since been allowed to lapse.

The southerly section comprised 17 claims located about the southern part of Taylor Lake. On two of these claims, which lay about ½ mile (0.8 km) to the south-southwest of Taylor Lake, geological mapping was carried out. These two claims were found to be underlain entirely by diabase, and the results of the mapping indicated that:

Fawcett and Leonard Townships

Two narrow veins outcrop in the area of an olivine diabase dike in the north-east corner of claim M.R.39647. One is barren pink calcite, and the other – white quartz-calcite with chalcopyrite. Sampling and assaying revealed very minor silver values.

The intrusion of the dike has produced an area of jointing and fracturing in the adjacent diabase, but this jointing was not a feature of the diabase elsewhere on the claims.

(Assessment Work Files). It was further stated that:

The claims are underlain by Keweenawan Nipissing diabase, with no significant veining, faulting, jointing or mineralization. Minor sulphides were observed in one vein, and mineralization in very small quantites occurs throughout the diabase.

(Assessment Work Files).

On the northern set, located about Herron Lake and the northern part of Taylor Lake, trenching and diamond drilling were carried out, where

at least eight parallel veins are known to exist. These veins are in diabase dipping flatly to the east under the adjacent Keewatin rocks. It is hoped that trenching and sampling will give sufficient information to permit drilling under the Keewatin rocks to intersect the veins in the diabase close to contact. The contact extends in a north-south direction.

(Northern Miner 1965, p.12(597)). In this area five diamond drill holes were drilled to a total of 1,004 feet (306 m) in 1965 by Barron Diamond Drilling Limited. Banded iron formation, chalcopyrite, pyrite, cobalt minerals, sphalerite, specular hematite, lead minerals and narrow, ⅛ inch-10 inches (0.3-25 cm) carbonate veins were intersected. The best silver assay was 0.14 oz/ton over 0.5 feet (15 cm) (Assessment Work Files). The drilling was followed by a geochemical survey in 1966 (Sergiades 1968, p.416) the results of which are not known.

No map showing the location of these veins was available and no further work was recorded.

M.J. Sullivan (23)

During 1972 M.J. Sullivan held one claim, L267270, one mile (1.6 km) south of Fournier Lake in central Leonard Township. This claim formed part of the former Seville Exploration Syndicate Property and the Archibald Property.

In 1971 six diamond drill holes were sunk to a total depth of 420 feet (130 m) in diabase on this claim by United Reef Petroleums Limited. Chalcopyrite, pyrite, and galena were encountered. The core was assayed for silver and cobalt. The best silver assay was 7.50 oz Ag/ton from an intersected calcite vein and the best cobalt assay was 0.38 percent from the same vein (Assessment Work Files).

REFERENCES

Boissoneau, A.N.
1965: Surficial Geology, Algoma, Sudbury, Timiskaming and Nipissing; Ontario Dept. Lands and Forests, Map S465, scale 1 inch to 8 miles, Geology 1962-1963.

Burwash, Edward M.
1898: Geology of the Nipissing-Algoma Line; Ontario Bur. Mines, Vol. 6, Sec. 5, p.167-184 (published 1897).

Carter, M.W.
1972a: Macmurchy Township, District of Sudbury; Ontario Div. Mines, Prelim. Geol. Map P.765, scale 1 inch to ¼ mile.
1972b: Tyrrell Township, District of Timiskaming; Ontario Div. Mines, Prelim. Geol. Map P.766, scale 1 inch to ¼ mile.
1973: Fawcett Township, District of Sudbury; Ontario Div. Mines, Prelim. Geol. Map P.819, scale 1 inch to ¼ mile.
1973b: Leonard Township, District of Sudbury; Ontario Div. Mines, Prelim. Geol. Map P.820, scale 1 inch to ¼ mile.

Coleman, A.P.
1901: Iron Ranges of the Lower Huronian; Ontario Bur. Mines, Vol.10, p.181-212.

Collins, W.H.
1910: Montreal River District; *in* Geol. Surv. Canada, Summ. Rept. for 1910, p.196-202 (published 1911).
1912: Geology of Onaping Sheet, Ontario; Portion of Map-Area between West Shining Tree and Onaping Lakes; *in* Geol. Surv. Canada, Summ. Rept. for 1911, p.244-252 (published 1912).
1913a: Florence Lake, Shining Tree and Rosie Creek Areas; Ontario Bur. Mines, Vol.19, pt.2, p.194.
1913b: Geology of Gowganda Mining Division; Memoir 33, Geol. Surv. Canada, 121p. Accompanied by by Map 64A, at a scale 1 inch to 1 mile.
1917: Onaping Map-Area; Memoir 95, Geol. Surv. Canada, 157p. Accompanied by Map 153A at a scale of 1 inch to 1 mile, and Map 179A, at a scale of 1 inch to 4 miles.

Fahrig, W.F., Gaucher, E.H., and Larochelle, A.
1965: Palaeomagnetism of diabase dikes of the Canadian Shield; Canadian J. Earth Sci., Vol.2, p.278-298.

Finley, F.L.
1926: Wasapika Section, West Shining Tree Gold Area, District of Sudbury; Ontario Dept. Mines, Vol.35, pt.6, p.83-96.

Fisher, R.V.
1966: Rocks composed of volcanic fragments and their classification; Earth-Science Reviews, Vol.1, p.287-298.

Flint, R.F.
1971: Glacial and Quaternary Geology; John Wiley and Sons, Inc. 892p.

Fraser, E.M.
1973: "Red Rock" along Upper Contact of the Shining Tree Lake Diabase Sill; Unpublished B.Sc. Thesis, Queen's University, Kingston, Ontario.

GSC
1965: Smoothwater Lake, Ontario; Aeromagnetic Series, Map 1514G, scale 1 inch to 1 mile. Surveys flown 1959 and 1960.
1965: Opikinimika Lake, Ontario; Aeromagnetic Series, Map 1521G, scale 1 inch to 1 mile. Surveys flown 1959 and 1960.

Graham, A.R.
1932: Tyrrell-Knight Area; Ontario Dept. Mines, Vol.41, p.2, p.25-61.

Gross, G.A.
1965: General geology and evaluation of iron deposits; *in* Geology of iron deposits in Canada, Geol. Surv. Canada, Econ. Geol. Rept. No.22, Vol.1, p.90-91.

Hopkins, Percy E.
1920: West Shining Tree Gold Area; Ontario Dept. Mines, Vol.29, pt.3, p.29-52. Accompanied by Map 29a, at a scale of 1 inch to 40 chains.

Irvine, T.N. and Baragar, W.R.A.
1971: A guide to the chemical classification of the common volcanic rocks; Canadian Journal of Earth Sciences, 8, p.523-548.

Langford, Geo. B.
1927: Shining Tree Silver Area, District of Timiskaming; Ontario Dept. Mines, Vol.36, pt.2, p.88-97. Accompanied by Map 36c, at a scale 1 inch to ¾ mile.

Lovell, H. and Caine, T.W.
1970: Lake Timiskaming Rift Valley; Ontario Dept. of Mines, Miscellaneous Paper 39, 16p.

Miller, W.C.
1923: The Matachewan Series and its pre-Cambrian relations; Can.Min.Jour., Vol.44, p.298-299.

Northern Miner Press
1965: Silver Pack Mines to drill property in Cobalt District (article); The Northern Miner p.12 (597), July 1, 1965.
1971a: Jonsmith Gold, Copper Showings are new (article); The Northern Miner, p.18 (770), July 29, 1971.
1971b: Raylloyd completes first drill hole (article); The Northern Miner, p.5 (1053), October 21, 1971.

ODF
1971a: Forest Stand Map, Fawcett Township, 1971 Inventory, 1970 Photography. Scale: 4 inches to 1 mile or 1:15,840.
1971b: Forest Stand Map, Leonard Township, 1971 Inventory, 1970 Photography. Scale: 4 inches to 1 mile or 1:15,840.

ODM
1923: Shining Tree Lake Area; *in* Report of the Iron Ore Committee, with appendix; Ontario Dept. Mines, 306p. (published 1924).

ODM-GSC
1970: Sudbury and Timiskaming Districts, Ontario; Aeromagnetic Series, Map 285G (Rev.), scale 1 inch to 1 mile. Surveys flown 1947, 1948 and 1949.
1970: Timiskaming District, Ontario; Aeromagnetic Series, Map 284G (Rev.), scale 1 inch to 1 mile. Surveys flown 1947, 1948, and 1949.

Sergiades, A.O.
1968: Silver Cobalt Calcite Vein Deposits of Ontario; Ontario Dept. Mines, Mineral Resources Circular, No.10, 498p.

Stewart, R.B.
1912: West Shining Tree Gold District, OBM Vol.21, pt.1, p.271-277.
1913a: The West Shining Tree Gold Area; Ontario Bur. Mines, Vol.22, pt.1, p.233-237.
1913b: The Shining Tree Silver Area; Ontario Bur. Mines, Vol.19, pt.2, p.187-193.

Turner, F.J.
1968: Metamorphic petrology, mineralogical and field aspects; McGraw-Hill, 403p. New York.

Williams, H., Turner, F.J., and Gilbert, C.M.
1954: Petrography, An Introduction to the Study of rocks in thin sections; W.H. Freeman and Company, San Francisco, 406p.

INDEX

PAGE

Analyses:
Chemical 7, 10, 39
Normative 11
Andesite 9, 12, 37
Andesite-rhyolite contact 37, 38
Archibald claim 33, 39
Archibald property 46
Arenite 25
Quartz 14
Argillite 23
Arkose 23, 25
Asbestos 31, 38
Stringers 16
Assays 31, 32, 34, 35, 36, 38, 46
Associated Porcupine Mines Ltd. 40

Barringer Research Ltd. 37
Barron Diamond Drilling Ltd. 46
Basalt 6
Tholeiitic 7
Bennett-McVittie property 32
Bing Lake 32, 41, 44, 45
Bismuth 41, 45
Native 33
Black Lake
See: Soot Lake.
Bobtail Lake 15, 23, 28, 32, 42
Breccia 15
Basalt 9
Bullock, prospector 31, 34
Burke, prospector 31, 34
Burke Shaft 35
Burke Showing 31, 34
Burkett, L., property 31, 35

Calcite 26
Cameron Diamond Drilling Co. Ltd. 44
Caswell, Grant 41
Chalcopyrite 26, 33, 36, 37, 38, 40, 41, 42
See also: Copper pyrites.
Chert 14
Black 32
Clarkson, I.B. 35
Cobalt 26, 33, 43, 46
Cobalt bloom 26, 32, 33, 39, 40, 41, 42, 44, 47
Cobalt Group 5
Cochrane 31, 34
Conglomerate 15, 38
Polymictic 23
Photo 22
Copper pyrites 33, 39, 40, 43, 44, 45
See also: Chalcopyrite.
Coulee Lead and Zinc Mines Ltd. 41
Currie, W.F. 45

PAGE

Dacite 9, 12
Decker, A., deposit 32
Diabase 3, 5, 21, 38
Dikes:
Diabase 3, 5
Matachewan type 21
Diorite 37
Dunite 16

Eliza Lake 28
Exploration Projects 42

Faults 30, 36
Types of 29
Fisher Lake 5
Foley Lake 36
Fournier, A. 38
Fournier Lake 15, 31, 32, 38, 39, 41, 43, 44, 45

Gabbro, amphibole 26
Galena 33, 39, 42, 43, 46
Geo-Explorers Ltd. 44
Geophysical surveys:
Ground electromagnetic 36, 37, 44
Ground magnetic 37
Gold 30, 31, 34, 37
Native 35
Gowganda Formation-Nipissing Diabase contact 28
Granite Creek 34
Granite Lake 14, 15, 18, 31, 35
Granite Lake group, claims 35
Granite Lake pluton 3, 12, 13, 17, 18, 28, 29, 32
Granite Lake stock 28, 30
Granophyre 26
Graphite 37
Greywacke 14, 23

Hasset Lake 16
Hellens, A.D. 45
Hematite 15, 16, 32, 39
Specular 46
Herron Lake 29, 41, 42, 45, 46
Hornblende 9, 18
Horseshoe Lake
See: Herron Lake.

Irene Lake 5, 23
Iron 30
See also: Hematite; Limonite; Magnetite.

James, E.G. 35
Jasper 15, 30, 32
Jess Lake Fault 29, 36
Jonsmith Mines Ltd. 31

PAGE

Keewatin-Nipissing Diabase contact 42

Landagne, prospector 31, 34
Landagne Showing 35
Lead 46
  See also: Galena.
Limonite 39
Lithologic units, table of 4

Mackenzie and Mann Ltd. 38
McIntosh Mines Ltd. 40
MacNeil, A. 44
Magnetite 15, 16, 32, 38, 39
Malachite 36
Metamorphic facies 9
Metavolcanic-monzonite contact 18, 32
Michiwakenda Lake Fault 29, 30
Millerite 16, 38
Monzonite, hornblende-quartz 17
Monzonite-metavolcanic contact 18, 32
Mullen Lake 23, 25, 28, 29, 40, 42, 43, 44, 45
Muskeg 27

Nellie Lake
  See: Taylor Lake.
Nellie Lake Syndicate 41, 45
Niccolite 33, 40, 41
Nickel 31
  Nickel bloom 42
Nipissing Diabase 5, 26
Nipissing Diabase-Gowganda Formation
  contact 28
Nipissing Diabase-Keewatin contact 42

Ogilvie Syndicate 36, 37
Olivine 16

Papoose Creek 31, 34, 35
Paraconglomerate 23
Pentlandite 16, 38
Peridotite 16, 37, 38
Porphyry, feldspar-hornblende 18
Prospector Airways Co. Ltd. 34, 35
Pyrite ..16, 18, 26, 32, 35, 37, 38, 39, 40, 42, 46
Pyrrhotite 16, 37, 38

Quartz stringers 35

Ramsay, R.G., property 31
Raylloyd Mines and Explorations Ltd. 36, 37, 38
Rhyodacite 13
Rhyolite 12, 13
Rhyolite-andesite contact 37, 38
Rhythmite 23
Ribble vein 34
Rutile needles, sagenitic, photo 20

PAGE

Sand 27
Sandstrum Creek 27
Saville Prospecting and Exploration
  Co. Ltd. 31, 41, 46
Schist, quartz-sericite 13
Sequence, diabase-granophyre 28
Shining Tree iron range 16
Shining Tree Lake 5, 21, 25, 26,
  30, 33, 36, 39, 45
Siltstone 15, 23
Silver 26, 30, 31, 32, 41, 45, 46
  Arsenide 43
  Native 33, 39, 40, 44
Slim Lake 23
Smaltite 33, 40, 41, 43, 45
Soot Creek Fault 29
Soot Lake 5, 14, 15
South Sandstrum Lake 37
Sphalerite 37, 46
Spider Lake 15, 32
Spider Lake Fault 29
Spike Lake
  See: Mullen Lake.
Spud Lake 25, 40
Steep-Thompson prospect 41, 45
Structural methods 27
Sulphide minerals:
  See: Chalcopyrite; Galena; Millerite; Niccolite;
  Pentlandite; Pyrite; Pyrrhotite; Smaltite;
  Sphalerite.
Syenite 26

Taylor Lake 28, 29, 33, 41, 42
Thomas, Dalton, claim 40
Till, gravelly 27
Turnbull claims 43

United Reef Petroleums Ltd. 46

Veinlets, quartz-calcite 16
Veins, calcite-quartz 33
Voyager Explorations Ltd. 31, 34, 35

Walker Silver Mines Ltd. 40
Wapus Creek 25
Wapus Lake
  See: Fournier Lake.
West Montreal River 27, 37
West Montreal River Fault 29
West Wapus Creek 27
West Wapus Creek Fault 29
Worm-like borings 25
  Photo 24

Zircon 20

MAPS
NOT
FILMED

CARTES
OMISES